NutriBudget

Optimisation of nutrient budget in agriculture

D5.1 User stories from all user groups, at different scales and regions + functional specifications

Funded by the European Union

Delivery Report

Project Information	
Acronym	NutriBudget
Title	Optimisation of nutrient budget in agriculture
Project no.	101060455
Type of Action	RIA
Website	https://www.nutirbudget.eu
Deliverable Information	
Title	D5.1 User stories from all user groups, at different scales and regions + functional specifications
WP number and title	WP5 – Co-create the Nutriplatform
Lead Beneficiary	PwC
Authors	Susan Vrona Béjina (PwC), Yoldez El Gaaloul (PWC), Gerard Ros (WU), Chantal Hendriks (WR)
Reviewers	Else Bünemann-König (FIBL), Salim Belyazid (SU)
Description	User stories and functional specifications for the Nutriplatform prototype
Type	R – Document, report
Dissemination Level	PU - Public
Status	Final
Submission due date	30th April 2025
History of Changes	
Version 0.1	Draft created by PwC 25/4/2025
Version 0.2	Integration of reviewers' feedback updated by PwC 30/4/2025
Version 1.0	First version submitted 30/4/2025

Preface

The NutriBudget project aims to develop the prototype of a first-of-its-kind integrated nutrient management platform, called “NutriPlatform”, in various regions across Europe. The NutriPlatform will operate as a decision-support tool for farmers, advisors and regional authorities. Before the end of the project, the NutriPlatform will be tested and available to these users and interested citizens across Europe.

This report describes the outcome of the activities undertaken for the deliverable D5.1 “User stories from all user groups, at different scales and regions as well as to develop the functional specifications”, undertaken by PwC, in close collaboration with project members from different work packages (WP) whose valuable work is embedded in the tool capabilities: (WP1) Ghent University (Belgium) for agricultural mitigation measures, (WP2) Stichting Wageningen Research (the Netherlands) for nutrient modelling across Europe and (WP3) Wageningen University (the Netherlands) for the expression of gaps between a current and optimal nutrient budget status as NutriKPIs.

Work on this deliverable started in project month 28 (December 2024) resulting in the delivery of this report at the end of project month 32 (April 2025).

We would like to acknowledge the researchers and staff of Wageningen University (the Netherlands), Stichting Wageningen Research (the Netherlands), Ghent University (Belgium), Luonnovarakeskus LUKE (Finland), BETA – University of Vic (Spain, University of Milano (Italy) and Research Institute for Organic Agriculture – FIBL (Switzerland) for their contributions.

Executive Summary

The aim of WP5, is to build a prototype of the Nutriplatform for use as a decision support tool (DST) to assist multiple users (e.g. farmers, farm advisors, local authorities, researchers, and citizens) across various spatial scales (from farm to EU level). The tool will provide users with insights on their current and desired status for nutrient budgets and allow them to discover the most suitable measures to bridge the gap between their current nutrient budget status and an optimal nutrient budget status. The Nutriplatform will enable “scenario evaluation” allowing users to set environmental goals and discover and then select a series of applicable measures affected by market developments / policy implementations, to improve their nutrient budget status and permit the monitoring of changes (in soil fertility, soil C and nutrient budgets) over time.

This report describes the outcome of the activities undertaken for the D5.1 User stories from all user groups, at different scales and regions as well as to develop the functional specifications”, undertaken by PwC, starting in M28 and with the delivery of this report at the end of M32.

There is one task associated with this deliverable: Task 5.1 - Collect Nutriplatform user stories and functional specifications involving the following consortium participants: PwC, LUKE, UGent, UNIMI, UVic-UCC, and FiBL.

The Task 5.1 involves collecting user stories and requirements from a selected pool of users, and where possible, for the different case study regions. A user story refers to an informal, natural language description of features of a software system from the perspective of an end user or user of a system (here farmers, farm advisors, policy makers or other interested citizens). It aims to ensure that the technical conception of the tool and scientific work performed in WP 1, 2, 3 and 4 will be in-line with what the end user needs and is willing to use. A functional specification defines what the software system should do and what functions and facilities are to be provided. For the NutriBudget DST, the user stories contained in this report identify how the different user groups will interact with the tool, with the functional specifications outlining additional requirements necessary for the reliable implementation of the tool features.

User stories will be scored and prioritized according to their utility and implementation difficulty and are taken into consideration in the development of future deliverables including system requirements (D5.2), architecture blueprints and user interface mock-ups (D5.3). It is important to note that the user stories and functional specifications outlined in this document will be continuously refined based on user feedback solicited from user testing with the Nutriplatform (M5.3) during the iterative development of the DST (D5.4).

The Task 5.1 used inputs from previous WP: User communities (WP1), models and their functional inputs and outputs (WP2), KPIs/indicators (WP3) and indirectly from new data from best practices tested in the five pilots (WP4) and considered in the WP2 models.

The Task 5.1 was organised in a 4 step-approach:

Step 1: Identification of the expected users of the NutriBudget DST.

Step 2: Collect user requirements through desk research on existing tool studies, research on existing tools, online questionnaires, workshops and focus groups with identified stakeholders from other nutrient management studies, agricultural communities and tool users, and from the five different case study regions.

Step 3: Understanding the tool requirements according to specific local needs and specificities that could hinder or facilitate the uptake of the service in the different uptake areas.

Step 4: Consolidation of findings into user stories along with functional specifications for the DST solution.

The following sections of the report discuss the methodology for these 4 steps in detail. The results and discussion section contains the candidate user stories developed along with the functional specifications. The conclusion section describes the future uptake of the user stories and functional specifications in the future deliverables.

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Terminology & Acronyms

Item	Description
Agile	Agile software development refers to a group of software development methodologies based on iterative development, where requirements and solutions evolve through collaboration between delivery and business owner teams (cross-functional teams).
API	An Application Programming Interface is a set of commands, functions, protocols, and objects that programmers can use to create software or interact with an external system. It provides developers with standard commands for performing common operations so they do not have to write the code from scratch.
CAP	Common Agricultural Policy
Cookie, Cookies	A piece of text generated by a web browser/internet navigator software that is stored as a file locally on the internet visitors' computer. Initially conceived to store stepwise information regarding page-to-page navigation by a site visitor to the site delivering the site content, its usage has been widely extended, all involving some way of tracking a unique computer-navigator combination visitor. Tracked data can include web pages viewed or the delivery of web site contents including images or advertising links. A number of other digital events such as time spent looking at a page, or clicks performed by internet users via their web navigation activities can also be tracked using cookies.
D5.1	Deliverable 5.1
Database	A database is a data structure that stores organized information.
DIAS	Data and information Access Services
DST	Decision Support tool
Epic	Epic is a broad description of a functionality or feature. It usually is broken down into multiple User Stories or serves as a placeholder for a future feature. Used in the Agile development methodology.
EU	European Union
Farm	All agricultural holdings for a specific farmer
FaST / FaST platform	The Farm Sustainable Agriculture tool, a digital agriculture service platform for environment sustainability made available to EU farmers, Member State Paying Agencies, farm advisors and developers of digital solutions.
Feature	A distinctive attribute or aspect of a software system that provides a specific functionality or capability
Functional Specification	It details what the software system should do, including the requested properties of inputs and outputs
GA	Grant Agreement
Geographic Information System	A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present spatial or geographic data. It also offers the ability to create and edit maps. The main advantage of GIS is its capability to calibrate unrelated data coming from very different sources thanks to specific algorithms.
GDPR	General Data Protection Regulation

Item	Description
Holding	Strict term for all the related agricultural holdings for a farmer, colloquially referred to as a farm
HR satellite imagery	Satellite imagery with a meter or sub-meter resolution, that can be used as a support to detect and trace vectors features. Usually stitched based on images with no or minimal cloud cover.
Hybrid application	A hybrid application (hybrid app) combines elements of both native and Web applications. Native applications are developed for a specific platform and installed on a computing device. Mobile applications used on mobile devices can be considered as a hybrid application.
IACS	The Integrated Administration and Control System is a system whose objective is to ensure that correct payments are made to farmers and that there is traceability of payments. It is linked to the LPIS for the geographical aspects.
Indicators	Actual values for a given farm, things like N, P,K, C and metals values for a specific farm or farm parcel
ID	Abbreviation for identification or identifier. An identifier is usually a combination of characters including numbers and leaders that uniquely identifies an entity. In digital systems, many reference or access to entities are managed through a unique identifier, for example a person ID stored in a database.
KPI	Key performance indicator. A way of expressing success of an activity.
LPIS	The Land-Parcel Identification System
MFA	Multi-Factor Authenticator
Mitigation plan	A specific plan to reduce environmental impact for a farm consists of a farm context, a set of KPIs and their distance measures from actual to target, a Nutrifarm Score and the set of mitigation measures selected for this plan.
Mobile OS	Mobile Operating System. The underlying mobile handset software system on which a software application is installed. The OS permits usage of hardware, network and any associated resources needed by the software application to function. The mobile operating systems the most deployed today are provided by Apple (iOS) and Google (Android). Mobile OSs evolve as *versions*, and any software based on a particular version of an OS must be evolved to remain compatible with the underlying OS.
Mock-up	An image or set of images which displays the functional elements of a website or page, typically used for planning a site's structure and functionality and for soliciting feedback from stakeholders.
NMP	Nutrient management plan
NutriKPI	A numerical value calculated from the actual vs target values on a specific holding or parcel - calculated from the central geographic point for the holding or parcel
Nutriplatform	The name given to the decision support tool prototype in the project NutriBudget. A decision-support tool (DST) designed to assist various stakeholders, including farmers, farm advisors, local authorities, researchers, and citizens, in optimizing nutrient management across different spatial scales, from farm to European Union (EU) level
Nutrimodel	The impact model for nutrient management that predicts nutrient (N, P, K, S, Mg, Ca, Cu, Zn) and carbon (C) flows of major European farming systems from regional to farm scale used by the NutriBudget DST, Nutriplatform.

Item	Description
Nutriplan	A plan combining the set of mitigation measures taken together with an agricultural context (farm practices, soil data, spatial scale) to achieve a target nutrient state.
Parcel	Takes into account the definitions that vary from one Member State to another, e.g. Farmer's block, Agricultural parcel, Cadastral parcel.
Persona	A persona is a semi-fictional representation of a user with a given set of goals, wishes and intent.
PO	Project Officer
Precision agriculture	Precision agriculture, or "precision ag", is a farming management concept, using IT to modulate crop operations and input doses according to the intra-plot variability of the soil and crop needs. The advent of the internet enables all farmers to practice precision ag thanks to mobile apps, clouds and smart sensors.
Prototype	An early sample, model, or release of a product built to test a concept or process
Responsive web app	A web application that ensures a consistent user experience across various devices, including desktops, tablets, and smartphones.
Service	A service encapsulates business logic and presents a simple interface that abstracts away the underlying complexity acting as a black box.
Service Level Agreement	Service Level Agreement (SLA) is a commitment between a service provider and a client for an agreed upon percentage of availability for a platform or a service. An SLA is usually expressed by a technical definition in mean time between failures (MTBF), mean time to repair, mean time to recovery, and as a percentage of time that the service will be available.
Stand-alone application	A software term meaning that all of the application logic and data is encapsulated in software residing on the user's device. A stand-alone software application is written for each hosting operating system. Might also be called "heavy client".
Targets	Environmental goals that a Nutriplan seeks to help a farmer optimize for their holding or parcel
User Journey	A user journey is a series of steps, which represent a scenario reflecting how a user or persona might interact with the service / website / product in order to achieve a goal.
User Story	A user story is a description of a software feature from an end-user perspective. The user story describes the type of user, what they want and why. A user story helps to create a simplified description of a requirement. Used in the Agile development methodology.
UX	User Experience is the overall experience of a person using a product such as a website or computer application, especially in terms of how easy or pleasing it is to use.
Variable Rate Application	Variable Rate Application (VRA) aims at enabling an automated application of materials (N,P, K, lime…) to a given landscape, usually thanks to connected equipment and new technologies - especially from satellites (GNSS, hyperspectral imaging). VRA can be map-based or sensor-based.
Version	A software version represents a certain state of the software, at a given point in time with an associated set of capabilities. Usually expressed in a number format such as X.Xxx with 'X' representing major features, and 'x' representing minor changes and fixes.
Web application	A web-based application is any program that is accessed over a network connection using HTTP. Web-based applications often run inside a web browser. Web-based applications are also known as web apps.

1. Introduction

The NutriBudget project aims to develop an integrated nutrient management platform, Nutriplatform, to optimize nutrient budgets and flows across different agricultural production systems and regions in the EU.

The D5.1 ""User stories from all user groups, at different scales and regions as well as to develop the functional specifications", focuses on gathering user stories and defining functional specifications for the Nutriplatform. This involves understanding the needs and preferences of various stakeholders, including farmers, advisors, and policymakers, to ensure the platform meets their requirements. The main task of the deliverable, Task 5.1, involves collecting user stories and functional specifications through a structured approach. This task aims to capture the diverse needs and preferences of stakeholders to inform the development of the Nutriplatform[1].

WP5 activities during the development of user stories and functional specifications sought to establish the items detailed in Table 1-1.

Table 1-1. Deliverable 5.1 aims

Deliverable 5.1 aimed to establish:
- Expected users of the DST
- Capabilities offered by existing DST
- Capabilities that foster adoption of a DST by users
- Pain points to avoid or overcome
- How to expose the features of the underlying Nutrimodel and Mitigation measures catalog
- Tool requirements according to specific local needs and specificities that could hinder or facilitate the uptake of the service in the different uptake areas
- Local preferences / customizations, depending on user types, scales and climate zones
- Typical pathways through DST capabilities that capture primary paths through the DST (user journeys)
- Any functional requirements necessary to support the user journeys and user stories in the tool

[1] The terms 'Nutriplatform' and DST (for 'Decision Support Tool') can be used interchangeably.

2. Methodology

The main task of the deliverable, Task 5.1, involves collecting user stories and functional specifications through a structured approach. This task aims to capture the diverse needs and preferences of stakeholders to inform the development of the Nutriplatform. The approach to collecting user stories and functional specifications consists of four steps:

Step 1: Identification of the expected users of the NutriBudget DST to develop the list of potential users including current users of DST tools and any other relevant nutrient and/or carbon flow monitoring tool identified in other work packages, local farm advisory communities, farmers associations, local authorities, regional/national paying agencies[2], and any other critical stakeholder identified in previous activities suggested by partners and members of the project consortium.

Step 2: Additional user requirements were collected through desk research on existing tool studies, research on existing tools, online questionnaires, workshops and focus groups with identified stakeholders from other nutrient management studies, agricultural communities and tool users, and from the five different case study regions. The study team leveraged as much as possible existing relationships with local authorities (e.g., local, regional and national Paying Agencies) part of the FaST[3] project to ensure maximum engagement and involvement from end-users.

Step 3: The activities in this task consisted of understanding the tool requirements according to specific local needs and specificities that could hinder or facilitate the uptake of the service in the different uptake areas. It will notably allow the definition of map local preferences / customizations, depending on user types, scales and climate zones.

Step 4: The user stories were consolidated along with functional specifications for the DST solution. These specifications were reviewed and assessed by technical experts to ensure their feasibility in the technical context of the project, prior to moving to actual development in subsequent WP5 tasks. The outcomes of this exercise will therefore guide the actual prototype design and development of D5.3 (Architecture blueprints and interface wireframes) and D5.4 (Prototype DST, deployed and running on a cloud platform).

[2] Paying agencies are responsible for managing subsidy dispersements under the Common Agricultural Policy (CAP) of the European Union.

[3] Supported by the European Commission's DG Agriculture and Rural Development, by the EU Space Programme (DG DEFIS) and by the EU ISA2 Programme (DG DIGIT), the FaST digital service platform makes available capabilities for agriculture, environment and sustainability to EU farmers, Member State Paying Agencies, farm advisors and developers of digital solutions.

Each step was undertaken to ensure that the Nutriplatform is developed in a way that addresses the needs and preferences of its users, promoting its adoption and effectiveness in optimizing nutrient management.

The four-step approach consists of activities described in Figure 1-1 below and described in detail in the following sections, starting with desk research and review of existing tools, followed by the development of user stories and functional specifications.

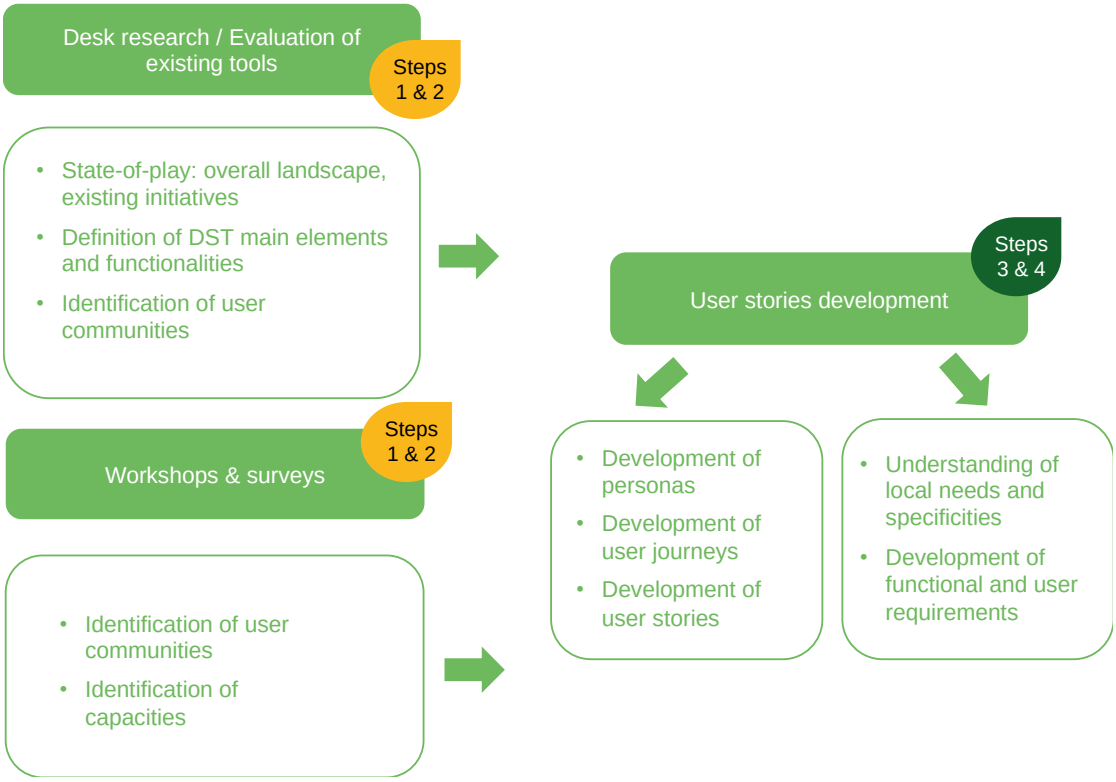

Figure 1-1. Activities and methodology DST User Stories and Functional Specifications

2.1 Desk research

We first focused on building an understanding of the background/context for sustainable nutrient management, through a selected literature review gathered from research undertaken initially for FaST adjusted for the scope of the current study. See Table 2-2. The collected data consisted of reports and publications from university and research institutes primarily in Europe with an orientation to farmers, farm advisors, researchers and policy makers. We concentrated on extracting information related to support for positive environmental outcomes through nutrient management, since these are key goals in the NutriBudget Horizon project. From these reports we evaluated available relevant indicators (C-soil surplus, CO_2-eq emission, N surplus, P balance, P surplus, NH_3 emissions, GHG emissions, C balance, C footprint) and the indicator unit (kg/ha or equivalents in the case of emissions values). We also explored the level of applicability of these indicators for display at different geographic scales and the level of applicability of an indicator at the country, region, farm and field level as these would be important for spatial scale related features and information display to the end user in the application. The resultant analysis is shown in Table 2-1.

Table 2-1. Spatial applicability of indicators

Indicator	Spatial applicability	Unit
NH_3 emissions	Country, farm	Tons NG3-N (country) kg NH_3 / ha (farm)
GHG emissions	Country, region, farm	CO_2 equivalent / CO_2-eq / ha
CO_2-eq emission	Farm	kg CO_2-eq / ha
C soil surplus	Farm	kg C / ha
C balance	Farm, field	kg C / ha (net C balance)
N surplus	Farm	kg N / ha
N balance	Country, region, farm, field	kg N / ha
P balance	Country, region, farm, field	kg P / ha
P surplus	Farm	kg P / ha
K balance	Farm	kg K / ha

Table 2-2. Tools / Publications survey

Primary author, title, URL, country	Climatic region, scale	Themes
BASF, Identification and solutions for climate-smart agricultural practices. BASF_Global-Carbon-Field-Trials-Report_2024--1-.pdf	N/A, farm	Climate, production
Agriculture and Horticulture Development Board, https://ahdb.org.uk/farm-excellence/the-farm/key-performance-indicators, UK	N/A, farm	Farm key performance indicators
Doorn, Biodiversiteitsmonitor akkerbouw, https://edepot.wur.nl/563407, Netherlands	temperate, farm	Climate, production, water quality, biodiversity
Aarts, ANCA, https://library.wur.nl/WebQuery/wurpubs/fulltext/407176 and https://edepot.wur.nl/582185, Netherlands	temperate, farm	Climate, production, water quality
Bastian, European Analytical Framework for the Development of Local Agri-Environmental Programmes, https://link.springer.com/article/10.1051/agro:2007027, Estonia, Germany, Hungary, Italy, Sweden, The Netherlands and Switzerland	temperate, region	Climate, production, biodiversity
Breitschluh, KSNL, https://www.umweltbundesamt.de/publikationen/folgenabschaetzung-einer-zunehmenden-bereitstellung, Germany	temperate, farm	Production, biodiversity, Water quality
Calker, Development and application of a multi-attribute sustainability function for Dutch dairy farming systems, https://www.sciencedirect.com/science/article/abs/pii/S0921800905002636?via%3Dihub, Netherlands	temperate, farm	Climate, production, biodiversity, water quality
Carof, SyNE, https://www.nefficiencycalculator.fr/en/ ; https://doi.org/10.1016/j.agsy.2018.01.015, Worldwide	all, farm	Water quality

Primary author, title, URL, country	Climatic region, scale	Themes
Conseil Scientifique de l'Environnement de Bretagne, Bilan Globale Azotée (Total Nitrogen Balance), https://cseb-bretagne.fr/index.php/component/remository/func-startdown/1/?Itemid=167, France	temperate, farm	Water quality
CoolFarm, Cool Farm Tool - Dairy Module, https://app.coolfarmtool.org/docs/api/quick-start.html#html-demo-tool, Worldwide	All, Farm	Climate
CoolFarm, Cool Farm Tool - Plant Production Module, https://app.coolfarmtool.org/docs/api/quick-start.html#html-demo-tool, Worldwide	All, Farm	Climate, production
Dantsis, Dantsis, https://www.sciencedirect.com/science/article/abs/pii/S1470160X09000971, Greece	temperate, farm	Climate, production, biodiversity, water quality
de Haan, Bodemindicatoren voor Landbouwgronden in Nederland, https://edepot.wur.nl/634579, Netherlands	temperate, field	Climate, production, biodiversity, water quality
FAO, SAFA INDICATORS, https://www.fao.org/nr/sustainability/sustainability-assessments-safa/en/, Worldwide	not specified, farm	Climate, production, biodiversity, water quality
Federal Bureau for Agriculture (FOAG), Agrarumweltmonitoring (AUI), https://www.blw.admin.ch/blw/de/home/nachhaltige-produktion/umwelt/agrarumweltmonitoring.html, Switzerland	temperate, farm	Climate, production, biodiversity, water quality
Field to market, Continuous Improvement Accelerator, http://fieldtomarket.org/media/2021/12/Field-to-Market_2021-National-Indicators-Report_FINAL.pdf, USA	temperate, farm	Climate, production, biodiversity, water quality
INL GmbH, REPRO, https://nachhaltige-landbewirtschaftung.de, Germany	temperate, farm, field	Climate, production, biodiversity, water quality
Meul, MOTIFS, https://link.springer.com/article/10.1051/agro:2008001, Belgium	temperate, farm,	Climate, production, biodiversity, water quality
Pacini, AESIS, https://agronomy.it/index.php/agro/article/view/ija.2009.1.23, Italy	mediterranean, farm	Climate, production, biodiversity, water quality
Rodrigues, APOIA-NovoRural, https://www.sciencedirect.com/science/article/abs/pii/S0195925509001267, Worldwide	not specified, farm	Climate, production, biodiversity, water quality
Ros, An Open Soil Health Assessment Framework Facilitating Sustainable Soil Management, https://pubs.acs.org/doi/10.1021/acs.est.2c04516#, Netherlands	temperate, field	Climate, production, water quality

Primary author, title, URL, country	Climatic region, scale	Themes
Ros, BedrijfsBodemWaterPlan. Maatwerk voor duurzaam bodem en waterbeheer, www.bbwp.nl, NL	temperate, field, farm	Production, water quality
SMK, On the way to planet proof - Eieren, https://downloads.smk.nl/Public/PlanetProof_documenten/Melk/2022/Certificatieschema%20OPP%20Ei%20DP23.1_incl%20aanvullende%20besluiten%20tot%2019-9-2022.pdf, Netherlands	temperate, farm	Climate
SMK, On the way to planet proof - Melk, https://downloads.smk.nl/Public/Criteria%20On%20the%20way%20to%20PlanetProof%20melk%20M2.1_maart%202023.pdf, Netherlands	temperate, farm	Climate, production, biodiversity, water quality
SMK, On the way to planet proof - Plataardige productie, https://downloads.smk.nl/Public/PlanetProof_documenten/Plantaardige%20producten%20(NL)/2023/NL%20-%20Certificatieschema%20On%20the%20way%20to%20PlanetProof%20Plantaardige%20Producten%20PP.5%20juni%202023.pdf, Netherlands	temperate, farm	Climate, production, biodiversity, water quality
Solagro, Carbon Calculator, https://solagro.com/works-and-products/publications/methodology-guidelines-for-the-carbon-calculator, Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom	temperate, farm, field	Climate
Solagro, DIALECTE, https://dialecte.solagro.org/, France	temperate, farm, field	Climate, production, biodiversity, water quality
Thalmann (project leader), RISE 3.0: Response-Inducing Sustainability Evaluation, https://www.bfh.ch/hafl/en/research/reference-projects/rise/, Worldwide	all, farm	Climate, production, water quality
Thiollet-Scholtus, INDIGO, https://www.sciencedirect.com/science/article/abs/pii/S116103011400104X?via%3Dihub, France	temperate, mediterranean, farm	Climate, production, water quality
van der Wal, Ontwerp Label Duurzaam Bodembeheer, https://www.clm.nl/wp-content/uploads/2021/09/910-CLMrapport-Ontwerp_Label_Duurzaam_Bodembeheer_ASR.pdf, Netherlands	temperate, farm	Production, Biodiversity
van Doorn, Integraal sturen op doelen voor duurzame landbouw via KPI's, https://edepot.wur.nl/548327, Netherlands	temperate, farm	Climate, production, biodiversity, water quality

Primary author, title, URL, country	Climatic region, scale	Themes
van Laarhoven, Biodiversiteitsmonitor melkveehouderij, https://biodiversiteitsmonitor.nl/docs/Biodiversiteitsmonitor_engels.pdf, Netherlands	temperate, farm	Climate, production, biodiversity, water quality
Viglizzo, A Rapid Method for Assessing the Environmental Performance of Commercial Farms in the Pampas of Argentina, https://link.springer.com/article/10.1007/s10661-006-7981-y, Argentina	temperate, farm	Climate, production, biodiversity, water quality
Zwart, De organische stof balans met de te verwachten stikstoflevering per teeltrotatie, https://edepot.wur.nl/272649; www.os-balans.nl, Netherlands	temperate, field, farm	Climate, production

2.2 Evaluation of existing tools

In addition to desk research, we conducted a comparative analysis of DST in Europe, with emphasis on tools for optimizing nutrient budgets and improving nutrient use efficiency in agriculture.

We concentrated on reviewing tool features and usability since in WP3 (D3.1 Report with overview of existing indicators used in national and European policies and market initiatives in relation to agronomic (e.g., yield, soil health) and environmental aims) have performed a complete review of tools with respect to NutriKPIs, emissions and soil quality. Therefore, we focused on a review of existing tools' capabilities to identify user profiles, key features and functionalities with an eye to design decisions and technical specifications required for developing the complete set of user stories and functional requirements necessary for tool implementation as described in Table 2-2. The comparison of these tools is given in Table 2-3.

Table 2-3. Existing Tool Comparisons

Tool name	URL	Description
AgBalance®,	https://agriculture.basf.com/global/en/sustainable-agriculture/climate-smart-farming/sustainability-assessments.html	Editor is BASF. Sustainable agriculture planning including environmental impact.
Litefarm	https://www.litefarm.org/	Sustainable farm planning tool https://ubcfarm.ubc.ca/csfs-research/litefarm/
Xarvio	https://fm.xarvio.com/fr/fr_fr/login	Farm book app. Farm exploitation task management.
NMI / BBWP	https://portal.nmi-agro.nl/ tutorial : https://bedrijfsbodemwaterplan.nl/tutorial.html	The Dutch Farmer oriented Soil and Water Plan, a running decision support tool developed in the Netherlands to guide the appropriate selection of measures to improve soil health, nutrient efficiency and ground and surface water quality.

Tool name	URL	Description
Mesparcels	https://mesparcelles.fr/	Recommended by the chambre d'agriculture in Occitanie, France. Manage crop traceability, regulatory procedures, track farm certification, manage technical and economic performance, management of fertilization plans, phytosanitary, connected services, certification.
OS Balans	https://www.os-balans.nl/nl/info	The Balance tool is for the sustainable agriculture in the Netherlands and is relevant to Dutch Legislation. By entering soil characteristics, cropping plans, and fertilizer amounts, it shows if the organic matter balance is positive and the portion of allowable P application used.
Cool Farm	https://app.coolfarmtool.org/account/login/?next=/docs/api/quick-start.html#html-demo-tool	Carbon Footprint Calculator (UK) Measure Greenhouse Gases, Biodiversity, Water Use & Food Loss & Waste
SyNE calculator	https://www.nefficiencycalculator.fr/en/	Nitrogen use efficiency calculator https://www.sciencedirect.com/science/article/abs/pii/S0308521X17306686?via%3Dihub
Sativum	https://www.sativum.es/	Developed by the Agrarian Technological Institute of Castilla y León (ITACYL) for farmers and advisors. Management of information on agricultural plots throughout Spain. Based on three evolving pillars : - Access to soil, climate, and crop data at the plot level through access to data from various sensor networks, Earth observation satellites, and databases. - Crop decision-making by developing tools based on agronomic data and models that guide producers in making decisions regarding fertilization, irrigation, etc. - Assists farmers in fulfilling obligations to the Public Administration through the field notebook and nutrient plan.
Navigator Tool	https://tool.fastnavigator.eu/	Web based tool for recommendation of nutrients at field scale and assessing the greenhouse gas emissions / removals and economic performance at farm scale
Faireshare	https://fairshare-pnf.eu/ https://www.h2020fairshare.eu/	DST Registry 326 tools and services. A Horizon 2020 Project.
Teagasc	https://www.teagasc.ie/crops/soil--soil-fertility/calculators/	Offers a wide range of NM tools. Included here for understanding types of reference data for DST tools.
Fertilicalc	https://www.uco.es/fitotecnia/fertilicalc.html	(Villalobos, 2016) allows the user to calculate the seasonal amounts of N, P and K needed and the most economic combination of commercial fertilisers for 149 crops. Also

Tool name	URL	Description
		provides estimates of the Ca, Mg and S balances in the field and acidification balance (CaCO3, kg/ha). Free – used in FaST for Spain and Tutorial : https://youtu.be/718bJpTtYeM?si=mUVYevsoM7zGoUaC
AGROgestor	https://www.agrogestor.es/ https://plataformaagrogestor.agroasesor.es/	AGROgestor was developed in the LIFE+11 ENV/ES/641 sigAGROasesor project. Two interconnected platforms with utilities and tools for advisory services on agricultural plots and for supporting collective crop management. The Decision Support Tools (DST) models allow integrating existing knowledge and the nutrient management (N, P and K) to the situation of each crop in each campaign in a specific plot, with its soil characteristics, type of management and weather conditions.
Overseer FM	https://www.overseer.org.nz/	This tool uses science models to analyse the impact of farm management on the flow of nutrients through the farm system. It generates balanced nutrient budgets for seven key farm nutrients that estimate the amount of nitrogen (N) leaching at the root zone and phosphorus (P) surface run-off. It also models the amount of methane, nitrous oxide and carbon dioxide generated on-farm and the amount of carbon sequestered in trees. Includes farm practice comparison scenarios.
FASSET Farm ASSEssment tool	https://www.fasset.dk/	Fasset a whole-farm dynamic model. The model distinguishes and links different farm components, including field (crops and soil), animals, housing and manure storages. It allows different field and farm management scenario building. This includes crop rotations, crop management, livestock feeding practices and managing manure. The model can be used for comparing with experimental data and for exploring consequences of environmental and management changes for farm productivity and environmental impacts.
Batfarm	https://www.batfarm.com https://cordis.europa.eu/article/id/127115-batfarm-software-will-enable-livestock-farmers-to-assess-the-environmental-impact-of-their-fa/it	The software was developed as part of the European Batfarm project designed to simulate the effect of a range of strategies designed to mitigate pollution on livestock farms dedicated to pigs, laying hens and poultry meat, and dairy cows. The tool allows different scenarios on each farm for comparison so the most suitable environmental strategy can be retained. The software covers all the phases in the production system: animal housing, storage, treatment and field application of manures and slurries.

Tool name	URL	Description
MarkOnline	https://segesinnovation.dk/produkter-og-ydelser/digitale-loesninger/mark-online/	Paid Danish tool with a GIS based farm management system for precision agriculture. Field book capabilities for tracking yearly farm events and plans.
TUdi project	https://tudi-project.org/ https://tudi.helion.hu/tudi/ https://tudi-soil.web.app/ https://tudi-services.agrisat.es	TUdi Project, as: "Transforming Unsustainable management of soils in key agricultural systems in EU and China. Developing an integrated platform of alternatives to reverse soil degradation" Experiment result repository. We will investigate for reference data as needed for functional specifications. Term experiments (LTEs) repository module consists of data from experimental farms and LTEs. Countries organized in a structure in which the unique attributes (such as site name, NUT3-code, geo-location, climate, etc.) that can be assigned to each site (experimental farms) are only uploaded once, while the data of (one or more) single LTEs (threats tested, degradation processes or other experimental objectives, range of data collected, etc.) at these sites are recorded under each site. Perform queries from the farms' and experiments' data and metadata, according to their purposes. There are Decision Support Tools linked to the TUdi project.
cropmanager.eu	https://www.cropmanager.eu	Support system for managing nutrients and crop production.
e-mission/Element	https://www.element.com	Industry online tool to plan and track emission testing programs and trend data.
FaST	https://fastplatform.eu/	Decision-support system (mobile application and web-based solution) for nutrient management planning. Modular design permits integration of local specificities for crops, algorithms, integration with local paying agencies IACS identification and farm LPIS data.
Farmstar	https://www.farmstar.com	Scalable, satellite and crop model-based services that can be integrated into variable rate application equipment. (larger scale farms or for integration into commercial tools)
https://app.at.farm/	https://www.yara.com	Quickly and easily measure the exact nitrogen requirements of developing plants using hand-operated tool. Integrates with desk top software. Interesting approach that mitigates using only NDVI, making it accessible to all farmers and in conjunction with a farm advisor.
Agricon/Agriport	https://www.agricon.de	Field and cultivation management. Precision farming specialist for information-driven, knowledge-based and automated crop production. Large set of management and nutrient planning capabilities.

Tool name	URL	Description
Verde Smart Nutritional kit and Verde Smart Pro kit	https://www.verdesmart.com	Sensor based solutions and consultancy and software applications for efficient use of water, fertilizer and treatments. Diagnosis of the concentration of N and K in the roots (and the leaching zone) and of balance of N and K in the plant.
Farm Eye	https://www.farmeye.ie	Nutrient monitoring and planning application. Additional services for carbon, nitrogen and water quality. Must go through sales to get login.
Manner/PLANET	https://www.planet4farmers.co.uk/manner.aspx	Software tool that provides farmers and advisers with an estimate of crop available N, P, K supply. Stand alone software for desktop. Oriented UK/Scotland
NutriGuide/NutriZones	https://www.nutriguide.com	Fertilisation planning tool. Very straightforward minimalist tool.
Farmdok	https://www.farmdok.com	Field and farm management software and digital field index. Precision farming. Mobile and web versions.
Agrosmart	https://agrosmart.com.br/	Suite of tools for agri business (Brazilian).
WatchITgrow	https://www.watchitgrow.com	Digital crop monitoring. Support for growers of arable crops and vegetables.
Excel spreadsheets	https://microsoft.com	Flexible, but requires mastering a excel formulas.
SATAGRO	https://satagro.fr/#app	Flexible IT tool for nutrient management in area of export to machine terminals. Polish tool, cumbersome UI/UX
NDICEA	https://organic-farmknowledge.org/fr/tool/32609	Free digital tool for calculating nutrient scores for crop rotation practices at the field level (OK-Net Arable Practice abstract available)
VegSyst-DSS	https://w3.ual.es/GruposInv/nitrogeno/VegSyst-DSS/VEGSYST-DSS%20Help.pdf	Desktop nutrient planning tool. Specific for Spain.

2.3 Workshops

This activity included conducting workshops with stakeholders to gather user stories and requirements, participating in demonstrations of existing nutrient management tools and platforms, and conducting surveys with participants.

The sessions were conducted mainly online due to the user population and project scope located across Europe. Lessons learned from these sessions led to the creation of detailed user stories and functional specifications, described later in the results and discussion section of this document.

A detailed description of the first international co-creation workshop, and additional workshops conducted is given in Table 2-4.

Table 2-4. Workshops listing

Workshop name	Goals	Outcomes	Attendee affiliations	Roles
27/10/2025 1st International Co-creation Workshop (MS13)	- Introduce the NutriBudget project and the Nutriplatform and set the stage for future participation and solicit feedback from participants. - Covered key topics such as project objectives, mitigation measures catalog, NutriModels and NutriKPIs, and Nutriplatform features to gather feedback.	- Usage statistics regarding existing tools - Review and prioritization of desired features - Contact information for future participation for wire-frame mock-up and tool testing	Agrarian Technological Institute of Castilla y León International Latvia University of Life Sciences and Technologies Piemonte Region Government of Andalucía Draxis Environmental S.A. Eurofins Scientific Aequator Groen & Ruimte Yara International European Commission Nomos Bio University of Milan Aeres Univ. of Applied Sciences	Farm advisors, farmers, policy makers, researchers, and private sector agriculture actors.
3/12/2025 Bi-lateral workshop. Use Cases, Integration with other tools	Demonstrate features from ITACYL tool Sativum such as farm management, nutrient balance, application of fertilizers, plant protection	- Potential to integrate with Nutribudget DST allowing data exchange and pre-population of relevant data.	Agrarian Technological Institute of Castilla y León	Farm Advisor / public servant

Workshop name	Goals	Outcomes	Attendee affiliations	Roles
	products, and satellite data integration.			
07/04/2025 WP5 Dev Kick Off workshop	Overview of Nutri Budget project. Address technical aspects such as API consumption, data integration, tools and environment requirements for development.	- Planned to set up bi-lateral workshops with WP2 API Team	PwC	Cloud technology & software development subject matter experts
10/04/2025 User stories - Review session 1	Review of user stories - Login & Localization - Integration with external systems - Data handling & Export - Visualisation & Mapping	- Prioritize user stories regarding manage farm & nutrient mitigation plan - Develop using Responsive Design to support both mobile and web interfaces - Explore Integration with FAST: technical feasibility and requirements for integrating with the FAST system	PwC	Cloud technology & software development subject matter experts
11/04/2025 User stories - Review session 2	- Review possible parcel database sources sources and integration, internationalization, data returned by the NutriModel API, Creating farms and parcels, backend services, Nutrimodel (WP2) API integration	- Undertake review of parcel databases (LPIS, other…) - Review of GIS services - Review of satellite tiling services - Review internationalization requirements - Review SMTP service - Plan backend tasks	PwC	Cloud technology & software development subject matter experts

Workshop name	Goals	Outcomes	Attendee affiliations	Roles
14/04/2025 Bi-lateral Workshop Nutrimodel API -> DST	Review NutriKPI, NutriModel, Environmental goals, mitigation measures exposed by API Review API endpoints	- Knowledge sharing on API structuration by WP2 - Schedule more workshops to cover integration points Nutrimodel API <> DST	PwC Wageningen University	API subject matter experts, Cloud technology & software development subject matter experts

2.4 Elaboration of the four-step approach

2.4.1 Identify expected users of NutriBudget

Due to the international nature of the project, workshops were held in English. This limited participation of workshops to primarily representatives from research and policy institutions and farming associations, and the participation of fewer farmers. To address the difficulty in collecting input from farmers, we conducted desk research and reviewed a number of existing tools and set up bi-lateral workshops to review tools with farm advisors and Nutrient management tool editors who have intimate knowledge of the farmer user. Other critical stakeholders were identified in previous activities suggested by partners and members of the project consortium. These included policy makers and researchers, which we activated by communicating workshop invitations for diffusion to work package leaders and through the communication channels put in place by project participants from RISE (WP6), and the project coordinator UGent (WP7).

We also leveraged as much as possible existing relationships with local, regional and national Paying Agencies that were formerly part of the FaST project, to ensure maximum engagement and involvement from end-users. The initial 9 regions/countries participating fully in FaST that were candidates to participate to such engagements included: Piemonte (Italy), Castilla y Leon (Spain), Andalusia (Spain), Estonia, Wallonia (Belgium), Romania, Bulgaria, Greece, Slovakia. Of these, only Piemonte (Italy), Castilla y Leon participated in our workshops. This was because of the 9 regions/countries initially participating in FaST only 3 have current installations of FaST: the paying Agency of Wallonie (Belgium), Greece and Romania. Of these three, only Wallonie and Greece are operational. Wallonie chose to participate in a bilateral workshop, and at a future date, beyond the period of this report.

2.4.2 Development of user requirements

The user requirements were collected through the activities described above, but also through online questionnaires during workshops with identified stakeholders from the five different case study regions who participated in the 1st International Co-creation Workshop (MS13).

We used the Agile software development methodology applied to our research, surveys and workshop findings to develop user requirements in the form of user stories and functional requirements. Agile is a software development philosophy which emphasizes an iterative approach to developing software, with close collaboration between the users of the solution and the developers of the solution to provide value to the end user.

Based on our research, “Personas” were defined, who represent a user with specific goals to accomplish using the tool. Activities undertaken to achieve goals were grouped together for each defined Persona, into user journeys. The user journeys make use of “User Stories”, tracing each Persona’s interaction with the tool to achieve specific goals.

The individual user stories which were revisited several times as we gathered new information from our different research and workshop activities, updating them to make them more complete or accurate.

2.4.3 Ensure service according to local needs and specificities of local preferences, user types, geographical scales and climate zones

The activities in this step were elaborated to make sure that the Nutribudget DST would be operational according to specific local needs that could hinder or facilitate the uptake of the service in the Nutribudget study areas. The Nutribudget tool must allow the definition of maps and local preferences / customizations, depending on user types, scales and climate zones. We determined the spatial applicability of indicators used during different use cases at the Country, regional and farm scale (results indicated in Table 2-2.)
Additionally, during the bi-lateral workshops, desk research and tool review, the areas of local preferences explored consisted of the criteria listed in Table 2-5.

Table 2-5. Local preferences criteria

Criteria
Ergonomy & adoption ○ Mobile vs web ○ Tool usage patterns ○ Cost
Language and units
Agricultural practices and reference data ○ Crops ○ Fertilizers ○ Climate zones ○ Applicability of mitigation measures ○ Parcel identification (availability of farm and parcel geometries)
Applicability of mitigation measures
Parcel identification

2.4.4 Consolidation of functional specifications for the DST

The supporting requirements for user stories were also consolidated and translated into functional and user specifications for the DST solution. These specifications will be reviewed and assessed by technical experts to ensure their feasibility in the technical context of the project, prior to moving to actual development in subsequent WP5 tasks. The outcomes of this exercise will therefore guide the actual prototype design and development of T5.3 Architecture blueprints and interface wireframes and T5.4 DST, deployed and running on a cloud platform.

3. Results and Discussion

In our desk research and tool comparisons, and also due to the authors' experience with other Nutrient Management tools and sustainable agriculture projects at the EU level, the expected users of NutriBudget were identified to fall mainly into two groups: farmers, and to the extent that they are directly involved in serving farmers through consultation, and farm advisors, as the principal users identified for the tool. There is however a strong and vibrant community of researchers and policy makers as tool users, as evidenced in the large number of DST tools reviewed for the current deliverable. In D3.1, WU already proposed two principal use cases, modified here to express two principal user journeys:

Farmer journey

- Sees actual carbon and nutrient budgets on field and farm level
- Evaluates the budgets in view of target values and critical values (expressed as "NutriKPIs")
- Shows the contribution of a series of mitigation measures (from MC, WP1) to inspire the farmer
- Recommends a package of "best management practices"
- Saves as a Mitigation plan for application and consultation over time

Policy maker journey

- Sees on regional level the actual carbon and nutrient budgets (NUTS2 or NUTS3 level)
- Sees the contribution of a series of mitigation measures to minimize the distance to target
- Illustrates the effect of various "best management practices"
- Saves as a RoadMap to share with constituents

We expanded on these principal use cases by constructing a set of Personas which represent a user's state at a given time, suggesting additional potential interactions with the tool as described in Table 3-1.

Table 3-1. Personas and Goals for the DST

Persona	Goals
Cost Conscious Farmer	• Earn while being more cost effective; • Efficient management of inputs while protecting water and soil quality, biodiversity and cutting GHG; • Generate an easy-to-use mitigation plan and achieve environmental goals while meeting yield objectives.
Informed Farmer	• Be able to communicate easily on the platform for support; • Decrease the need to master regulation details; • Access to appropriate mitigation measures relevant to my farm context; • Knowing that my privacy is respected and only relevant data is communicated via the application/platform to third parties (MS/PA/Advisors).
Technology Minimalist	• Clear, simple and timely tool so the minimum amount of time necessary is spent in the tool; • Not waste time on data input duplication; • Be able to work in the tool for one or a few parcels and a single crop through simple visualisations; • Positioning, camera and geolocation features are useful.
Happy Policy Maker	• Compliance with new CAP legislation • Easy two-way communication with farmer base, directly to the farmer's device • Impact beyond nutrient management • Flexibility to develop/customise/localise the tool for my needs • Control and comprehension of implementation options and roll out means

Data Enthusiast	• Access to consolidated anonymized information in some accessible data format • Optimisation of IT resources, data volume and data treatment chains through a modular architecture • Deployed on a Cloud for easy support, access and availability

3.1 User story identification

As stated earlier, “User Stories” were created for the mapping of a Persona’s journey within the tool, showing how each user would interact with the tool to achieve a desired outcome or goal. These user stories were grouped into “Epics”, where an “Epic” is a collection of related user stories that will eventually evolve into menu items represented in the User Interface of the Nutriplatform.

The definition of Epics and User Stories helped develop a first draft architecture for deployment of the tool D5.2.

The user stories for the NutriBudget were organized by collecting and categorizing user stories from the insights gained during desk research, tool evaluation, user workshops and surveys, and refining them after considering the different user profiles, user journeys through the tool. Finally, the user stories were grouped logically into features called ‘Epics’. The set of proposed Epics appears in Table 3-2 below.

Table 3-2. Nutribudget DST epics listing

Epic name
Web or mobile app
Account management
Communication, Admin, Privacy & Legal
Data Visualisation
Manage Farm
Mitigation measures catalog
Nutrient mitigation plan
Policy maker
Soil data management

User story identification was focused on understanding the user requirements that the NutriBudget tool must answer, as well as the journey a user (specifically a farmer or policy maker) would undertake when interacting with the tool.

To address these tasks and fine-tune the user requirements, we undertook desk research, workshops, conducting interviews with various stakeholders from multiple Member States. Integrating the information gained from this consultation helps ensure the tool addresses the needs and concerns of the different user groups and to encourage a high user uptake.

The next step was to utilize the information from the background research in order to group together user traits that share a set of specific goals to accomplish through using the tool. These groups were expressed as “personas”, and for each defined persona, the activities required to achieve the end goal will be used to construct “user stories”, tracing each persona’s interaction with the tool to reach the specific persona’s goals.

These user stories were grouped into “Epics”, where an “Epic” is a collection of related user stories that will eventually evolve into menu items represented in the User Interface of the farmer application.

Additionally, we propose a technical and functional architecture, addressing both backend (server-side) and front-end (UI/web) concerns, and including the solutions needed for core processing of imagery and feed data. The technical architecture is defined in D5.2 System specifications – Nutribudget DST.

3.2 Integration of Workshop findings

The first international co-creation workshop (MS13) was held on January the 27th, 2025, to introduce the NutriBudget project and the DST tool, or Nutriplatform. Additionally, the workshop served to solicit interest from participants in future testing for the tool and to gather feedback on user stories and requirements. The participants came from different backgrounds: researchers, farmers, policy makers and interested citizens.

Participants were encouraged to provide feedback on various aspects of the Nutriplatform through an interactive tool called Slido. This feedback included the design and usefulness of the NutriFarm score, desired features and functionalities, preferences for background information and data input methods.

This information has helped the team to build the skeleton of user journeys, user stories and functional specifications, by highlighting the most relevant functionalities and features to be implemented, including features that measure environmental impact

3.3 User Story Listing

The listing of user stories developed from our research, workshops and appear in the following set of tables. Each table represents a user story, the first row in each table shows the Epic name followed by the title of the user story:

Epic name	Title

When the User story description is sufficient, the *Details* row may remain unspecified. Additionally, when the exact fields related to the user story need to be defined during following work package deliverables the *Fields* row will contain the value "*TBD"* (To Be Determined).

The Personas represent the category of users of the application. Each user story is expressed from the point of view of the user, to express the goal of their interaction as the wished for outcome, pain point relieved, or value offered by the tool.

When the User story description is sufficient, the Details row may remain blank.

The set of user stories is a set of candidate or potential user stories to include in the final tool. The complete listing of will be refined during the development of the mock-up (also known as 'wire frames') of the tool during tasks related to future deliverables D5.3 Architecture blueprints and interface wireframes and D5.4 Prototype DST and are discussed later in this document (conclusions).

Table 3-3. Candidate User Stories Listing

	Create Account
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisors, All users
User story	As a new user of the Nutriplatform, I want to be given the possibility to create a new account, So that I can access the application and utilize its features.
Details	The user should be able to navigate to the account creation page from the application's homepage, where they will find fields for entering their first name,

	last name, email address, and password. Additionally, the page should include a "Create Account" button to complete the process.
Fields	TBD

	Login
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisors All users
User story	As a farmer, I want to be able to securely login to the Nutriplatform, So that my information can only be accessed by me and localised to me.
Details	When the user tries to login to the application, ideally, it is important to know where the user is located. If the location is unknown, it is necessary to ask the user to confirm their region and country. The system should give the farmer the ability to specify or change their region and country, as well as the option to consent to logging in using FaST (OAuth). There are two login scenarios to consider: one where the user's region and country are unknown, and another where this information is already known
Fields	ID, Password, Region: Format of list will be determined, Country: Format of list will be determined

	Login region and country already "known" or associated with an account
	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, when my region or country can't be determined by the application, I want to be able to select my region or country during the login process, So that the application can provide relevant Data to my Farm.
Details	If the user’s region and country are already associated with an account, they should still have the option to specify or change their region and country (eg the determined data is incorrect, or if for example, they have multiple farms in different geographies.
Fields	TBD

	Login region and country already "known" or associated with an account
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, When my region or country can't be determined by the application, I want to be able to select my region or country during the login process, So that the application can provide relevant Data to my Farm.
Details	If the user’s region and country are already associated with an account, they should still have the option to specify or change their region and country (eg the determined data is incorrect, or if for example, they have multiple farms in different geographies.
Fields	TBD

	Login we don't know region and country
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer,

	Login we don't know region and country
	When my region or country can't be determined by the application, I want to be able to select my region or country during the login process, So that the application can provide relevant Data to my Farm
Details	Ideally, the application should determine the user's location from the browser's language settings or by asking the user to accept geolocation from the web page or app, offering options such as "Allow while visiting the site," "Allow this time," or "Never allow," with a warning that if the user's farm cannot be localized, the application's functionality will be compromised. If the location cannot be determined, the application will provide the user with the ability to select their region and country.
Fields	TBD

	Manage account
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to see my basic account information, So that I can have an overview of my different farms, holdings, account info etc.
Details	The application should provide comprehensive features including basic farm and account information, change password functionality, and the ability to assign a farm. This will ensure that farmers can manage their accounts securely and efficiently while keeping all relevant information accessible and up to date.
Fields	TBD

	View farm
App	Farmer mobile & desktop app
Personas	Farmer Farm
User story	As a Farmer, when I first login to the Nutriplatform, I should land on a 'View Farm' Interface.
Details	
Fields	TBD

	Access year - farm data by year
Personas	Farmer
User story	As a Farmer, when I first login to the Nutriplatform and already in the 'View Farm' Interface, I want to be able select the specific year from a drop-down list or calendar input, So that I can access and view my farm data for a specific year.
Details	Accessing farm data by year is crucial for analyzing and comparing the performance and metrics of a farm over different years. Scenarios will be saved annually, and historical data should be imported along with the farmer's information. It is important to determine the time frame for a scenario, whether it should span from January to December or be specified by the farmer.

	Additionally, it needs to be decided whether this data should be entered during the scenario-building process or through another interface. If entered during scenario building, it should be clarified if the farmer can make changes once the scenario is saved and active. Historical data will be sourced from the Nutra Model.
Fields	Farm ID, Crop yield, Livestock management details, Soil properties, Fertilizer types and amounts

	Select Farm
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, When I log into the Nutriplatform, I want to be able to select which farm to work on, So that I can manage farm data and create a mitigation plan for a particular farm.
Details	The farmer can select the farm to work on, but the application must handle scenarios where the farmer is developing a 'mitigation plan.' In such cases, it would not make sense to allow changing the selected farm within this view, as it could disrupt the logical flow and accuracy of the mitigation plan being developed.
Fields	TBD

	Manage farm
App	Farmer mobile & desktop app
Personas	Farmer Farm Advisor
User story	As a user of the Nutriplatform (farmer or a farm advisor), I want to be able to work with a particular farm, So that I can accurately calculate nutrient budget and optimize farm management.
Details	The application should provide a comprehensive listing of all farms that the user has access to, allowing them to easily view and manage their various holdings. By clicking on the "work with this farm" option, the user can directly access detailed data and information related to the selected farm. This functionality ensures that users can efficiently navigate between different farms and focus on the specific data and tasks associated with each one, streamlining their workflow and enhancing their overall management capabilities.
Fields	TBD

	Select Environmental Goals
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to specify what my environmental goals for my overall activity are and their relative weights, So that they can be taken into account in the Nutrient Mitigation plan.
Details	As a farmer, the ability to specify environmental goals and their relative weights is crucial for incorporating them into the Nutrient Mitigation plan. The five goals include Soil Quality, Water Quality, Greenhouse Gas Emission reduction, Biodiversity, and Agricultural Production (Yield). Farmers should be able to

	select and prioritize these goals, assigning relative weights that total to 100 or 1, ensuring that their specific environmental objectives are effectively integrated into the nutrient management strategy.
Fields	TBD

	Calculate nutrient budget
App	Farmer mobile & desktop app
Personas	Farmer Farm
User story	As a Farmer, I want to calculate the nutrient budget for my Farm, So that I can optimize the nutrient management and improve farm productivity
Details	In the context of optimizing nutrient management for agricultural parcels, it is essential to provide farmers with accurate and editable nutrient data. The tool displays all nutrient values from the Nutrimodel to the farmer, allowing for both viewing and editing. These values are retrieved from the Nutrimodel based on the X; Y coordinates sent to the model for the specific parcel or farm. This ensures that the farmer has access to precise and relevant nutrient information tailored to their land.
Fields	Required values (same for Nutrient budget calculation): - Farm_id, Longitude, Latitude, field_area, crop_type, fertilizer_type, fertilizer amount, manure_type, manure_amount, cover crops, type of manure incorporation. Other values retrieved from Nutrimodel that can be updated by the farmer: - animal_type, animal_number, housing_days, crop_yield, residue_removal_index, irrigation, fertilizer_N_input, fertilizer_P_input, fertilizer_K_input, fertilizer_Ca_input, fertilizer_Mg_input, fertilizer_S_input,,liquid_manure_N_input, solid_manure_N_input, soil_type, SOC, clay_content, initial_CN_ratio, cation_exchange_capacity, base_saturation_topsoil, bulk_density_topsoil[location], init_pH_KCl_topsoil, init_OlsenP_topsoil, ESDB_texture, ESDB_root_depth, compost,biosolids

	Display NutriKPI values
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to see the distance between my actual farm status and target status as NutriKPIs, So that I can see my farm and parcel's performance or to create a mitigation plan.
Details	In the context of optimizing nutrient management for agricultural parcels, it is crucial to have a detailed understanding of crop needs and soil conditions. For each parcel or crop, the tool computes nutrient needs based on available soil data, the presence of catch crops, and a table of crop needs. This information is presented in the form of tables, maps, and NutriKPIs, allowing for a synthetic and detailed view of seasonal crop needs on the parcels. The tool operates in a "prognostic" mode, utilizing a database of crop needs and catch crop performance, along with soil data from lab sampling or defaulting to regional data if sampling is unavailable.

Fields	TBD

	Nutriplan KPI Calculation
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer I want to calculate and review my farm's nutriplan KPI, So that I can monitor and improve my farm's performance.
Details	As a farmer, the ability to calculate and review the farm's NutriPlan KPI is crucial for monitoring and improving overall performance. Each time changes are made to soil, crops, or mitigation measures in the user interface, the NutriKPI will be recalculated and redisplayed. This continuous recalculation is essential for the farmer to understand their farm values and manage the farm effectively.
Fields	Required values (same for Nutrient budget calculation): - Farm_id, Longitude, Latitude, field_area, crop_type, fertilizer_type, fertilizer amount, manure_type, manure_amount, cover crops, type of manure incorporation. Other values retrieved from Nutrimodel that can be updated by the farmer: - animal_type, animal_number, housing_days, crop_yield, residue_removal_index, irrigation, fertilizer_N_input, fertilizer_P_input, fertilizer_K_input, fertilizer_Ca_input, fertilizer_Mg_input, fertilizer_S_input,,liquid_manure_N_input, solid_manure_N_input, soil_type, SOC, clay_content, initial_CN_ratio, cation_exchange_capacity, base_saturation_topsoil, bulk_density_topsoil[location], init_pH_KCl_topsoil, init_OlsenP_topsoil, ESDB_texture, ESDB_root_depth, compost,biosolids

	Nutrifarm Score
App	Farmer mobile & desktop app
Personas	Farmer, Farm advisor
User story	As a farmer, I want to be able to see an easy to digest overall performance score for my farm, So that I can see my farm's environmental impact.
Details	The goal is to provide an easy-to-digest overall performance score for a farm, highlighting its environmental impact. This score, derived from the NutriFarm API, must include at least emission and removal information. The farmer is presented with a few simple indicators to assess environmental impact and soil condition, ensuring the information is aggregated sufficiently to prevent information overload. Provide farmers with a clear and concise performance score to easily assess their farm's environmental impact and soil condition without being overwhelmed by excessive information.
Fields	TBD

	Create mitigation plan
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to create a mitigation plan,

	Create mitigation plan
	So that I can optimize nutrient management on my farm.
Details	As a farmer, creating a mitigation plan is essential for optimizing nutrient management on the farm. This process begins after defining farm and parcel data, allowing the farmer to continuously monitor their overall NutriFarm Score and NutriKPIs. At any point, the farmer can prioritize five different environmental goals—Soil Quality, Water Quality, Greenhouse Gas Emission reduction, Biodiversity, and Agricultural Production (Yield)—and observe any changes in their Nutri scores. They can also select and apply mitigation measures, recalculating their scores accordingly. This dynamic approach enables the farmer to save the updated plan as a Mitigation plan, ensuring effective nutrient management and environmental sustainability.
Fields	Inputs (actual): Nutrient Balance concentrations for annual N,P,K, Ca, Mg, S input rate in kg/ha/yr Outputs (target): Nutrient Balance concentrations for annual N,P,K, Ca, Mg, S input rate in kg/ha/yr NutriKPI : (difference between actual and target) Selecting appropriate mitigation measures based on Environmental Goals Integration with the Nutra model for default values and applicable mitigation measures. Calculation engine for Nutri KPIs (from Nutrimodel) Fertiliser(s) - organic & chemical concentrations: fertiliser amount, manure amount (kg/ha/yr) Selected environmental goals and weights Selected Mitigation Measures

	Limit selection to appropriate Mitigation measures
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, whenever I consult mitigation measures for the creation of my mitigation plan, I should only see mitigation measures appropriate to my geography: **If: Atlantic, Boreal, Continental and Mediterranean are selected in the region field, the proposed values from the mitigation measures catalog should be narrowed down to only nutrient surplus () **If: Continental + nutrient deficit are selected in the region, the proposed values from the mitigation measures catalog should be narrowed down to only nutrient deficit () So that I can only choose one the measures that is relevant to My region
Details	The tool will request and display only the mitigation measures from the Nutrimodel that are relevant to the farmer's specific context. The application will send the geometry of the point at the center of the farm or parcel, depending on the scale the user is visualizing, whether it be a country, region, or parcel. This process will occur consistently, regardless of whether the user is a farmer, farm advisor, or policy maker, whenever data is being retrieved from the Nutrimodel API. Additionally, a farmer can select more than one mitigation measure.
Fields	TBD

	Mitigation Measures Selection
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to select appropriate mitigation measures for my farm

	So that I can improve my farm's nutrient management
Details	In the context of enhancing farm nutrient management, it is essential for farmers to have access to effective tools and resources. As a farmer, once logged into the Nutriplatform, the goal is to select appropriate mitigation measures for the farm. This process allows for the improvement of the farm's nutrient management, ensuring better environmental and economic outcomes.
Fields	TBD

	Nutriplan Scenario Building
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to create and manage nutriplan scenarios, So that I can optimize my farm's nutrient management.
Details	In the process of optimizing nutrient management for farms, it is essential to evaluate both economic outcomes and environmental impacts. After calculating the initial NutriKPIs, the farmer will browse and select mitigation measures, then recalculate the NutriKPIs for their farm. Starting from default values provided by the Nutrimodel, the farmer can input specific data related to their farm. The user experience will query the Farm Optimiser API, which calculates the economic outcome and environmental impact for a given nutrient management plan, providing an optimal nutrient management plan based on the cost function.
Fields	Farm ID, Year, Logitude, Latitude, Animal Type, Number of animals, Housing Days, Crop Type, Nutri KPI (Dropdown List), Mitigation Measures, Cover Crops Required.

	Select mitigation measures during the creation of a mitigation plan
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to select an appropriate mitigation measure for my Farm, So that I can create an effective mitigation plan to optimize nutrient management.
Details	To create an effective mitigation plan for optimizing nutrient management, it is essential to select appropriate mitigation measures for the farm. The scenario can be built by choosing which mitigation measures to apply, while the Nutrimodel will maintain the relationship between applicable mitigation measures based on the region and other factors.
Fields	TBD

	Calculate mitigation plan cost
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to calculate related cost for a mitigation plan, So that I can see if it corresponds to the economic context for my farm.

Details	In order for the Mitigation Plan to be prioritized on the basis of economic benefit, a theoretical sale price must be specified for each type of crop. This sale price can also be pulled from either: book values, or from the Nutrimodel or Nutrifarm services through the Nutrimodel API.
Fields	TBD

	Edit draft mitigation plan
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to edit a saved mitigation plan draft, So that I can construct different mitigation scenarios.
Details	A farmer can save a draft of their nutriplan scenario and continue working on it later. This draft status allows the farmer to save their progress without needing to have all the required values filled in, although this feature is yet to be confirmed. NutriKPI calculations will not be performed until all necessary values are provided.
Fields	TBD

	Save mitigation plan as active plan
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to save my mitigation plan as an active plan, So that I can apply and track my progress
Details	As a farmer, having the ability to save and track a mitigation plan is essential for effective management. This active plan allows the farmer to monitor their progress and compare it against new scenarios or updated values. It is important to note that a farmer can only have one active mitigation plan at a time, which can be saved and followed to ensure effective management and adaptation to changing conditions.
Fields	TBD

	How I am doing?
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to track my progress against my active Nutriplan, So that I can see if I am meeting my nutrient management goals and identify areas for improvement.
Details	As a farmer, tracking progress against an active Nutriplan is essential to determine if nutrient management goals are being met and to identify areas for improvement. This involves comparing current values to target values in the active Nutriplan, with NutriKPIs displayed in the app as sliders showing number and unit values, similar to the NutriFarm score. The process may include updating soil samples or applying mitigation measures to observe any improvements or degradations in the NutriKPIs.
Fields	Farm ID, Year, Longitude, Latitude, Field Area (Numeric Field: Where to display a value calculated from the parcels parameters (To be defined and

	confirmed)), Animal Type, Number of animals, Number of housing animals (inside), Crop yield, Crop type, Crop cover, Soil Properties.

	Select Year
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisor, Policy maker, all users
User story	As a user of the Nutriplatform, I want to have an easy way to switch between years, So that I can work with mitigation plans that are related to a current year.
Details	The mitigation plans are only valid for a given year period, so selecting a year will filter all by the year selected. Applies only to mitigation plans.
Fields	TBD

	Compare Mitigation Plans from year to year
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to compare mitigation plans from year to year, So that I can evaluate the effectiveness of different strategies over time and make informed decisions for future nutrient management.
Details	The farmer will want to compare their progress on NutriKPIs after creating a mitigation plan. The ability to compare between mitigation plans, or between the active mitigation plan and the target provided by the Nutrimodel (displayed as charts or other)
Fields	TBD

	Parcel visualization
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, already logged in the Nutriplatform application, landed exactly on the 'Visualize my Farm' section, When I click on the Map, I want to be able to navigate to the parcel navigation section, So that I can see a detailed and interactive map of my farm parcels.
Details	When a farmer logs in, they will see a map of their region and will need to designate their farm either by inputting coordinates or drawing it on the map. Display of information labels such as plot name or current growth stage Select the layers to see on the map - crops, hazards, or satellite images.
Fields	TBD

	Define farm boundaries
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer I want to be able to set up my farm boundaries, So that I can work in the Nutriplatform
Details	The farm boundaries need to be designated by the system if available and modifiable by the farmer. If the farm boundaries are unknown, the application must provide a mechanism for defining them. In cases where the farm boundaries are not yet specified, the user would need to either input the coordinates for their farm or draw their farm on a map. This process involves

	Define farm boundaries
	dragging and dropping to select the region for the farm and then defining all the parcels.
Fields	TBD

	Draw parcel
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to draw the boundaries my parcels on a map, So that I can accurately define the areas making up my farm.
Details	A parcel can be selected from an LPIS layer or other sources from which the farmer can attach it to the farm. If a parcel is not already in the LPIS, the boundary can be drawn on top of a high-resolution satellite image, with the process eased by snapping the boundary points to roads and infrastructure, rivers, lakes, ponds, or custom geo-located points added in the tool. The newly created parcel should be confirmed against intersections with existing LPIS parcels, raising at least a warning if there is an overlap. Alternatively, a parcel can be created based on geo-located points added in the tool, either by walking to the point and using the geolocation features of a smartphone or by entering coordinates. It would be beneficial to develop algorithms that automatically detect the boundary of a parcel based on satellite imagery, allowing only final adjustments to be made. LPIS errors should not block the creation of a parcel and therefore a nutrient plan, easing the mapping inputs.
Fields	TBD

	Adjust parcel
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisor
User story	As a user of the application (farmer or a farm advisor), I want to be able to adjust the parcel boundaries, So that I can make it more accurate.
Details	The vertices of the polygon describing a parcel can be changed, with the proposed editing UX being similar to the one in the user story Draw Parcel. Additionally, a parcel can be split into two or more parcels using polygonal selections or slicers. This functionality allows for correcting or adjusting parcels to address errors or adapt to changes in the field.
Fields	TBD

	Delete parcel
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisor
User story	As a farmer, I want to be able to remove a parcel because I have transferred ownership or am not cultivating it any longer or I have made an error during parcel creation, So that I can have accurate data.
Details	The farmer can remove a parcel definition from his/her farm, in case he/she does not use it anymore. Removing a parcel from a farm should not remove the historical data of this parcel for this farmer (as this data is used to build subsequent NMPs).

	Delete parcel
	Keep parcel inventory current and avoid bloating the interface with irrelevant/old data, while still keeping a historical track of all agricultural activity A parcel that is part of an active mitigation plan can not be deleted.
Fields	TBD

	Farm setup and administration
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer I want to be able to set up my farm details So that I can have default values for my farm and correct inputs for nutrient mitigation planning.
Details	The farm setup can be divided into different groupings : Farm properties (general & location), livestock (livestock_general), crop management (crop management, water management), nutrient management (deposition, fertilizer, manure), soil properties (soil_property)
Fields	The fields that can be either retrieved (Nutrimodel) edited and or entered are: Values that must be specified : (application) : farm_ID, year, longitude (degree), latitude(degree), field area in ha, crop type, fertiliser type, fertiliser amount, manure type, manure amount (kg/ha/yr), cover crops (y/n), type of manure incorporation (shallow injection, deep injection, surface application). The following field listings (possible valid values) can be retrieved from Nutrimodel, giving the farmer options to specify: Crop type, fertilizer type, manure amount, type of manure incorporation Values that can be specified (not required to be entered by farmer because retrieved from the model. However the farmer can update values for their farm: animal type, animal number, housing days, crop yield, residue removal index, irrigation applied in mm/year, annual N,P,K, Ca, Mg, S input rate in kg/ha/yr. Liquid and solid manure_N_input (annual N input rate of liquid or solid manure., Soil type (default list supplied), Soil Organic carbon content in %, Soil clay content in %, Raton of the initial soil carbon and nitrogen content, cation exchange capacity in mmolc/kg, initial soil base saturation topsoil in %, soil bulk density of top soil, initial soil pH extracted by KCl of topsoil, ESDB_Texture (Listing : ["Sand", "Loam", "Clay", Heavy clay", "Peat"]), ESDB_root_depth in cm, manure compost or biosolids in kg/ha/yr

	Add Fertilizers
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to set-up the chemical fertilizers for my farm, So that they are available for creating mitigation plans at different levels (parcel, etc) as settings available for my farm.
Details	A farmer can set up the fertilisers types in use for their farm from the existing fertiliser sources provided by the Nutrimodel. They can only select existing types. They can't add a fertiliser type

	Add Fertilizers
	Any fertilizer type saved for the farm, is available during the creation of a Mitigation plan. (Use stories - set up a farm, and edit fertilizers, mitigation plan creation.)
Fields	TBD

	Add Manure
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to set-up the manure for my farm, so that they are available for creating mitigation plans at different levels (parcel, etc) as settings available for my farm.
Details	A farmer can set up the manure types in use for their farm from the existing manure sources provided by the Nutrimodel. They can only select existing types. They can't add a manure type Any fertilizer type saved for the farm, is available during the creation of a Mitigation plan.
Fields	TBD

	Add Nutrient source
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to add an organic nutrient source to my farm, So that I can manage and optimize my crop yields effectively.
Details	In the Farm, Nutrient Sources section, users can add and edit sources, including editing the animal or chemical source for the manure and adjusting the nutrient source analysis information.
Fields	TBD

	Add animal information
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to add animal inventory to my farm, So that I can have necessary data for generating a mitigation plan
Details	From a list of available animals, the farmer can add an animal inventory to his/her farm. This is necessary in case the manure generated by the animals is used for fertilization. The start event of the animal inventory should be timestamped. A farmer can have different types of animals, and animals can be Manure figures can automatically be calculated based on animal inventory and known databases
Fields	TBD

	Livestock management
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer,

	Livestock management
	I want to be able to manage my livestock information, So that I can accurately input and track data (type and number of animals, number of days housed inside)
Details	Livestock will be specified by the farmer at the farm level, and they will select it for the parcel and mitigation plan if relevant. Additionally, Livestock management would be a part of data farm setup The farmer will need to provide information on whether they have livestock, the type of animals, the number of each type, and the number of days the animals are housed inside. This information must be filled in to help calculate the NutriKpi.
Fields	TBD

	Edit Animal information
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to update the animal information for my farm, So that my mitigation planning will be accurate and complete.
Details	The farmer can add/modify/remove animals from his/her inventory at any time. These edits should be properly timestamped for later manure calculations.
Fields	TBD

	Add crop
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisor
User story	As a Farmer, I want to add crop information to my farm's, So that I can manage and optimize my crop yields effectively.
Details	Including crop type, crop yield, residue removal index, and irrigation details is essential for a comprehensive nutrient management plan. These elements provide critical information that influences nutrient requirements and management strategies. Additionally, determining the default values for these parameters ensures consistency and accuracy in the planning process, allowing for more effective and tailored nutrient management.
Fields	TBD

	Parcel Crop management
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to add crop data, So that it will be taken into account for the creation of a mitigation plan
Details	Set at farm and then again at parcel and mitigation plan level. On each parcel, the farmer can list the crops he/she intends to grow.
Fields	TBD

	Display farm specific data
App	Farmer mobile & desktop app
Personas	Farm Advisor, Farmer

	Display farm specific data
User story	As a user of the Nutriplatform, I want to be able to see any farm specific data I have entered every time I use the application, So that I can prevent tedious data rentry.
Details	Farm data should be saved locally in Nutiplatform and/or retrieved from Nutimodel, with a clear protocol for resolving conflicts when they arise. Any data entered for a farm should be retrievable for the user, including data entered by them or retrieved from FaST or other platforms where the user has granted NutriBudget permission to access their data. This ensures that all relevant information is available and up to date, facilitating effective nutrient management planning.
Fields	TBD

	Retrieve third party solution data (FaST)
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want my data to be imported from FaST or any other 3rd party application, where I have given Nutriplatform permission to retrieve my farm data, So that I can ensure that my farm data is accurate and up-to-date.
Details	This means setting up the farmer with a key in the FaST system giving this permission, and associating it with this farmer's account, allowing NutriBudget to retrieve FaST farm data to update farmer data in NutriBudget
Fields	TBD

	Modify soil Data
App	Farmer mobile & desktop app
Personas	Farm Advisor
User story	As a farmer, I want to be able to modify the soil data in the system, So that I can ensure the information is accurate for my farm's nutrient management plan.
Details	the farmer should be able to choose a soil sample data that he has already put in the system. Overwrite default Nutrimodel values with hand entry values.
Fields	TBD

	Connect soil sample coming from a Laboratory
App	Farmer mobile & desktop app
Personas	Farm Advisor
User story	As a farmer within the Nutriplatform, if a soil sample is received directly from a laboratory integrated with the platform, I want the received results to be integrated directly with the platform So that I can easily review interpret and manage the records
Details	
Fields	TBD

	Upload soil sample data
App	Farmer mobile & desktop app
Personas	Farm Advisor, Farmer
User story	As a farmer, I want to be able to import or upload my soil data, So that I can avoid double entry of data, typing errors, use the lab results immediately in the Nutriplatform,
Details	The tool proposes either: The farmer to upload their soil results (ie via a CSV file or excel) these results then appear immediately in the farmer's app or an import mechanism on the smartphone (for example using the "Share" feature from the farmer's email client) where it is up to the farmer to import the analysis results in the tool Note: This feature requires the lab analysis report to be reasonably standardized, at least within each implementation of the tool.
Fields	

	Enter / Upload Soil sample Data
Personas	Farm Advisor, Farmer
User story	As a farmer with an access to the Nutriplatform, When I navigate to the soil data section, I want to be able to either enter or upload from one-to-many soil sample measurements or soil sample data, So that I can keep accurate records and make informed decisions based on soil health.
Details	
Fields	TBD

	Export Mitigation plan
App	Farmer mobile & desktop app
Personas	Farm Advisor, Farmer
User story	As a farmer, I want to be able to export my mitigation plan, So that I can refer to it outside the Nutriplan.
Details	This includes exporting to document formats (e.g. pdf), tabular formats, map formats, proprietary formats (e.g. tractors VRA software)
Fields	TBD

	Consult mitigation measures catalog
App	Farmer mobile & desktop app
Personas	Farm Advisor, Farmer, Policy Maker
User story	As a user of the Nutriplatform, I want to navigate to the mitigation measures catalog , So that I can easily browse it's and access the information I need to increase my understanding of environmentally sound farm practices.
Details	Farmers need to make informed decisions that enhance the sustainability and productivity of their farming practices. By comprehending the available

	Consult mitigation measures catalog
	measures, they can effectively address environmental challenges such as soil degradation, water pollution, and greenhouse gas emissions. The catalog is organized into individual mitigation measures that have a hierarchical grouping by category, providing a structured approach to selecting appropriate actions. Examples of measures are to be determined, and it is essential to detail the fields to be used to ensure clarity and effectiveness in implementing these measures.
Fields	TBD

	Create and view road map
App	Farmer mobile & desktop app
Personas	Policy maker
User story	As a policy maker with access to Nutriplan application, I want to get insights at regional to EU levels in order to make informed decisions, so that pollution due to excessive use of nutrients and nutrient losses in the environment would be limited and reduced.
Details	The policy maker will access this functionality from either the mitigation plan functionality or maybe as a specific reporting feature to view aggregated data by region (on choropleth maps or charts/tables TBD.) Based on the user's location (detected) or selected Region on login, the user will view a map and see the related data relative to this map area, including: Soil data, NutriKPIs, applicable Mitigation measures, applicable regulations. The user will be able to view mitigation measures cards for each to understand what the characteristics are for each. The user will have the ability to create a mitigation plan at the EU or Regional or Country level and save it. There will be a year associated with the plan, but they do not have to have 'active' status. They can be manipulated at will.
Fields	TBD

	Manage regulations
App	Farmer mobile & desktop app
Personas	Policy Maker
User story	As a policy maker, I want to see applicable regulations in my region
Details	These regulations will be available from Policy Maker Road Map capability
Fields	TBD

	Export Roadmap
App	Farmer mobile & desktop app
Personas	Policy Maker
User story	As a policy maker with an access to the Nutriplatform, I want to be able to export my roadmap, So that I can refer to it outside the Nutriplatform.
Details	This includes exporting to document formats (e.g. pdf), tabular formats, map formats, proprietary formats (e.g. tractors VRA software)
Fields	TBD

	Data Request
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to access to the farm data stored in Nutriplatform , So that I can use it with as I see fit.
Details	All the data tracked for a farm is exportable to tabular format, and either ready for download or forwarded by email on demand by the farmer.
Fields	TBD

	Tool tips
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a Farmer, I want to be able to hoover on tooltips or information icons (i) , So that I can understand the required input, purpose and details of the fields without leaving the current screen
Details	Tooltips or information icons (i) for fields that require data input from the farmer. - all fields should show units or - all fields should have a (i) or some way of getting info on what the field is - where possible, fields should display correct format mask. An example DD/MM/YYYY to assist the user in entering values - required fields should be indicated with an * - user should be warned to complete a required field if the field is empty - the user should be warned to correct the input value if it exceeds the acceptable range. Note: The Nutrimodel should return acceptable ranges when queried.
Fields	TBD

	Navigation
App	Farmer mobile & desktop app
Personas	Farmer, Farm Advisor, Policy maker, All users
User story	As a user of the Nutriplatform, I want to be able to easily navigate and work with the different capabilities in Nutriplatform, So that
Details	The different capabilities that might be displayed for example in a bottom menu on a mobile phone or menu in a web app. This listing contains ideas that should be defined and updated, for instance: Home - display the current farm score, link to active mitigation plan, Mitigation plans, Farm(s), Account etc.
Fields	TBD

	Language and units
App	Farmer mobile & desktop app
Personas	All users
User story	As a user of the Nutriplatform, I want to be able to access the Nutriplatform in my language, So that I can view the application in my native language and understand the measurements accurately.

	Language and units
Details	The tool should automatically detect the language of the user (browser language or geo-localisation). The user should be able to change the language of the interface. The tool is localized in all the official languages of the member states, choice of metric or imperial units is provided, as well as other regional settings (e.g. decimal representations, etc.) as necessary for the farmer to have an environment fully customized to his/her local culture
Fields	TBD

	Reset password
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a user of the Nutriplatform, I want to be able to reset my password in case I lost it or for security or other reasons, So that I can securely access the Nutriplatform.
Details	The user should be able to request to reset password. Potentially this could go through a reset password link or a support request (See contact Use case). Could go through an admin capability that is a switch set by the app admin to force the user to create a new password. Need to treat the use case where the user does not remember their old password.
Fields	TBD

	Cookie Consent
App	Farmer mobile & desktop app
Personas	Farmer advisor, Farmer
User story	As a user of the application, When I log into the application for the first time, I want to be presented with a clear and comprehensive privacy policy, So that I can give informed to either consent or decline to the use of my data and understand how it will be used and protected.
Details	The user should be able to set and save cookie settings and also edit them if necessary.
Fields	TBD

	Data Consent
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to consent to the use of my Data in Nutriplatform and Nutrimodel So that I can contribute for better information regarding soil conditions and evolution for policymaking
Details	The user will be asked specifically if they give permission to import their data from connected tools. The user will be asked specifically if they give permission that their data be integrated into the underlying Nutrimodel database and model. For example, permission that their data be shared with Farm advisors of their choice Permission to share anonymous data for policy makers (example: number of farmers with mitigation plans in Nutriplatform.

	Data Consent
	The farmer can contribute to the underlying soil database in the Nutriplatform and the Nutrimodel by opting to share his/her data. This data is then quality checked and inserted in the Nutriplatform database.
Fields	TBD

	GDPR data use
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be informed of how my data is used and how it is protected from intrusion/theft, So that I can be legally informed and know that the app is GDPR compliant
Details	The farmer is presented with a clear explanation of how their data is used (and especially if it is used for controlling purposes). Understand how my data is used and how it is protected from intrusion/theft.
Fields	TBD

	Delete my data
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to exercise my right to remove my data from the Nutriplatform because I want to, So that I can maintain control over my data privacy and security
Details	The application should make sure that one can leave the tool without leaving his/her data behind. GDPR requirement The application should be able to retrieve all data related to an farm account. The user should be warned If they also ask to have their data removed (as an irreversible step). The user should be able to download or somehow receive their farm data (for example in a CSV format)
Fields	TBD

	Provide my data
App	Farmer mobile & desktop app
Personas	All users
User story	As a user of Nutriplatform I want to ask for my data in accordance with GDPR in the EU
Details	The application should be able to retrieve all data related to an farm account. The user should be warned If they also ask to have their data removed (as an irreversible step). The user should be able to download or somehow receive their farm data (for example in a CSV format)
Fields	TBD

	Documentation
App	Farmer mobile & desktop app
Personas	Farmer
User story	As a farmer, I want to be able to understand how to use the Nutriplatform. So that I can get the most out of it.
Details	KPIs, Nutriscores etc. Possibility to use Tool tips, roll overs, bubbles instead of formal documentation. Could be a FAQ. Must be in users' language.
Fields	TBD

	"Contact" - technical support / NutriBudget / Nutriplatform project information request
App	Farmer mobile & desktop app
Personas	Any user of the application
User story	As a user of the Nutriplatform, I want to get easily in touch with Nutriplatform support either for information request or technical support, So that I can resolve any issues encountered promptly.
Details	To access the list of available contacts, the farmer should navigate to the contact section of the application. Here, they will find a list of contacts that are available on the platform, including technical support and NutriBudget contact
Fields	TBD

	Log out
App	Farmer mobile & desktop app
Personas	All users
User story	As a user of the Nutriplatform, I want to be able to log in but also to log out, So that I can protect my account.
Details	There will be a log in and log out capability displayed to the user.
Fields	TBD

3.4 Functional Specifications

The functional specifications detail requirements for the NutriBudget DST that can be technical or non-technical in nature. In creating the user stories, when we found requirements that applied to parts or to the entire application and may or may not be directly associated with a given user action, user story or user journey, they appear here. The functional specifications are required for the application to successfully be deployed, supported and to meet the users' needs.

Table 3-4. Functional requirements listing

Category	***Functional Requirements***
Localisation	The UI elements will display in the language selected by the user. This will include UI field labels, text, tool tips, units etc.[4]

[4] The full listing will be developed based on the mock-up

Category	Functional Requirements
Localisation	The application will support at a minimum, the languages associated with the 5 study pilot regions and English.[5] Test Region listing: - Belgium - Atlantic Region - Finland - Boreal Region - Switzerland - Continental Region - Italy - Continental Region - Spain - Mediterranean Region
Localisation	When the user accesses the application, the interface should display in the default language associated with their country or region
Ergonomy	Clear simple and intuitive layout
Ergonomy	Cheap or free access to the app, to ensure that all farmers can access it.
Ergonomy	Possible access on Mobile device for on-field decision support
Ergonomy	Provide information in a timely manner
Ergonomy	Avoid duplication of information input into the tool
Ergonomy	Fast to use and to understand, not too time consuming
Display	Visualization of the Farm and parcels should be map based
Display	Visualization of the LPIS farm boundaries on maps
Display	Visualization of information in user-friendly customizable layers
Features	The application of some mitigation measures can span time frames from 1 to 5 years
Features	Possible ingestion with existing available relevant data base (LPIS, LUCAS, local soil samples data bases if it exists)
Features	Interconnections with available digital tools (i.e. FaST)
Features	Import/synchronize data from FaST for a farmer subscribing to Nutribudget from FaST
Features	Use this digital tool to gather all relevant data at the same place (one-stop shop approach) and optimise data use
Features	The application should have maps for the EU at the correct resolution and at a Nuts2 or Nuts3 level.
Features	The application will call the Nutrimodel API using the scale (EU27 / country / nuts2 / nuts3) and the region or country name. At the farm-level the application will send latitude and longitude coordinates, The application will thus send the centroid of the parcel(s). when it is retrieving data from the Nutrimodel API.
Features	Policy makers can have any number of 'roadmaps'. A Roadmap can be saved without attributing ‘active’ or ‘draft’ status since a policy maker will not be 'applying ' a Roadmap to any associated agricultural strategy on a parcel.
Features	Policy makers can have any number of 'mitigation plans' which can be saved without attributing ‘active’ or ‘draft’ status since a policy maker will not be 'applying ' a mitigation plan to any associated agricultural strategy on a parcel.
Features	Within a user account, for a given parcel there can only be one associated ‘Active’ mitigation plan for a single year. This is to permit the tracking of the effect of the plan during and at the end of the year.
Features	There is no limit to the number of draft mitigations that can be associated with a parcel.
Features	An account can have multiple farms, but most will have only 1

[5] The list of supported versions of web browsers and mobile phone form factors will be established during the mock-up design.

Category	Functional Requirements
Features	A Mitigation Plan is computed based on: - Manure production onsite - Manure imports - Manure exports - Computed Crop needs (Nutrimodel) - Available chemical fertilizers selected by the farmer It is composed of: - An inventory of nutrient sources on the farm (manure, crop residues, catch crops) - The nutrient composition of these sources (entered values, look ups to the Nutrimodel or imported soil sample measurements) - Procedures for storing and handling these nutrient sources - Manure spreading rates for each parcel (or sub parcel, if applicable) - Final nutrient balance for each parcel
Features	For a mitigation plan the data associated with it will be the farm data present at the time of creation. (a snapshot)
Features	Compare Mitigation plan progress from year to year
IT Architecture	There is no possibility to edit 'type' references for crops, fertilizer, livestock listing, manure type, countries, because these are fixed by the underlying Nutrimodel. Certain 'meta data' are excluded – ie N, P
	For a mitigation plan the data associated with it will be the farm data present at the time of creation. (a snapshot)
IT Architecture	Easily customisable for local environment
IT Architecture	Rudimentary (backend) administration: user management, main settings, manual data export etc.
IT Architecture	An account can be associated with only one of the following user profiles: Farmer, Farm advisor, Policy maker, Researcher, Guest.
IT Architecture	A special profile or role will exist 'Manager'. This role will have permissions to perform administrative tasks on the platform.
IT Architecture	Accounts must have a flag of type. The type being 'Farmer', Farm Advisor, Policy maker etc.
IT Architecture	User account management (self-service or by an admin?)
IT Architecture	Run on a cloud
IT Architecture	Enable modular and extensible services
IT Architecture	Scale to handle expected volumes of data
IT Architecture	Open source "core "
IT Architecture	Login should support Multi-Factor-Authentication
IT Architecture	The application will create a unique farm ID for each farm. This ID will be used to retrieve saved model runs from the Nutrimodel API
Inputs	No need to input the same information on various applications
Inputs	Inputs can be modified at any moment to adjust the nutrient management plan
Inputs	All default valued user entry fields displayed in Nutriplatform will be retrieved from the Nutrimodel API, including 'type' reference listings for 'types' (i.e. Crop type, fertiliser type, manure amount, type of manure incorporation)
Inputs	There is no possibility to edit 'type' references for crops, fertilizer, livestock listing, manure type, countries, because these are fixed by the underlying Nutrimodel.
Inputs	The Nutrimodel requires the following farmer inputs: farm_ID, year, longitude (degree), latitude(degree), field area in ha, crop type, fertiliser type, fertiliser amount, manure type, manure amount (kg/ha/yr), cover crops (y/n), type of manure incorporation (shallow injection, deep injection, surface application)

Category	Functional Requirements
Outputs	Optimize resource utilisation and costs thanks to the app
Data privacy	Guarantee the anonymization of the farmers data
Data privacy	Need to enter your personal data once for all, but grant the possibility to change the login on the same phone
Ecosystem	Not harm the commercial initiatives at the local or European level
Deployment	Provide technical documentation and user-friendly tool tips

4. Conclusions and recommendations

4.1 Main findings

An assortment of tools is available for nutrient management, many of which incorporate sustainable agriculture features. The future Nutribudget application thus joins a rich offering, but with the possibility to provide complementary and differentiating features.

Through the underlying Nutrimodel, a farmer using Nutribudget will have the ability to understand their farm's nutrient balance within the larger European environmental and nutrient balance in a straight forward and understandable way through NutriKPIs. A unique value proposition for the tool will be to offer the farmer the capability to develop and save a mitigation plan including selected appropriate mitigation measures and save as a scenario, available for consultation over time. This will enable the farmer to see the evolution of their farm's NutriKPI scores, in support of selected environmental goals after the selection of and hopefully, the application of her set of selected Mitigation measures to her farm. Additionally, the ability to browse the catalog of mitigation measure as an educational feature, can help the 'Informed Farmer' to be exposed to a set of field validated measures, appropriate to their climactic, geo-spatial and specific farm practices.

4.2 Key messages

According to (EIP-AGRI Focus Group, 2022), the following properties are needed for a Nutrient management tool. The table below describes how the NutriBudget Nutriplatform tool seeks to achieve these important recommendations.

User-friendly tools with straightforward user interfaces and advanced user experience	Nutribudget Nutriplatform, will be deployed in both a mobile and web ready version. The targeted features will be developed with optimal ergonomic principles and validated through user workshops and the availability of an interactive mock up to validate user features and user experience
Interoperability with other tools and data sources.	Nutribudget Nutriplatform will be integrated with FaST, as an example of how the tool inter-operate with the existing Nutrient management tool ecosystem – a win in terms of complementary functionality.
Flexibility with possibilities to customize for different farming environments and conditions.	The tool will be localised to the user's context including language and units. Thanks to the underlying Nutrimodel, the tool will display relevant data for the farmer based on their geographic, climatic zone, crops and practices.
Based on **reliable methods and algorithms**, scientifically sound and published.	Use of the Nutrimodel API exposing the Nutrimodel, developed in WP2
Able to access **publicly available and relevant data**.	The tool will make use of default data provided by the underlying Nutrimodel, and where possible will integrate openly available parcel data.

4.3 Next steps and recommendations

The set of user stories is a set of candidate user stories to include or not in the tool. The complete listing of will be refined during the development of the mock-up (also known as 'wire frames') of the tool during tasks related to future deliverables D5.3 Architecture blueprints and interface wireframes and D5.4 Prototype DST, deployed and running on a cloud platform:

- Task 5.3 - Design of the prototype Nutriplatform
- Task 5.4 - Iterative/agile development of the Nutriplatform

- Task 5.5 - Integrate the Nutriplatform with existing tools

The criteria applied during the selection of the final set of user stories will include:

- Value to the user
- Cost to implement (largely expressed as development time, but also to include maintenance cost)
  Fulfillment of goals for the DST as set out in the project proposal.
-

The user stories and functional specifications will continue to evolve throughout the iterative development of the Nutribudget Nutriplatform.

5. Annexes

5.1 Annexe 1 Epic Listing

Table 5-1. Epic listing

Acronym	Epic Name
WM	Web or mobile app
MF	Manage Farm
NMP	Nutrient Mitigation Plan
DV	Data Visualization
SDM	Soil Data Management
MMC	Mitigation Measures Catalog
PM	Policy maker
AM	Account management
COM	Communication, Admin, Privacy & Legal

5.2 Annexe 2 Epic – User Story Listing

Table 5-2. Epic - User story listing

Sort	ID	User Story	Epic
1	WM01	Create Account	Web or mobile app
2	WM02	Login	Web or mobile app
3	WM03	Assign account type	Web or mobile app
4	WM04	Login region and country already "known" or associated with an account	Web or mobile app
5	WM05	Login we don't know region and country	Web or mobile app
6	MF06	Manage account	Manage Farm
7	NMP07	View farm	Nutrient Mitigation Plan
8	NMP08	Access year - farm data by year	Nutrient Mitigation Plan
9	WM09	Select Farm	Web or mobile app
10	MF10	Manage farm	Manage farm
11	MF11	Select Environmental Goals	Manage farm
12	NMP12	Calculate nutrient budget	Nutrient Mitigation Plan
13	NMP13	Display NutriKPI values	Nutrient Mitigation Plan
14	NMP14	Nutriplan KPI Calculation	Nutrient Mitigation Plan
15	NMP15	Nutrifarm Score	Nutrient Mitigation Plan
16	NMP16	Create mitigation plan	Nutrient Mitigation Plan

Sort	ID	User Story	Epic
17	NMP17	Limit selection to appropriate Mitigation measures	Nutrient Mitigation Plan
18	NMP18	Mitigation Measures Selection	Nutrient Mitigation Plan
19	NMP19	Nutriplan Scenario Building	Nutrient Mitigation Plan
20	NMP20	Select mitigation measures during the creation of a mitigation plan	Nutrient Mitigation Plan
21	NMP21	Calculate mitigation plan cost	Nutrient Mitigation Plan
22	NMP22	Edit draft mitigation plan	Nutrient Mitigation Plan
23	NMP23	Save mitigation plan as active plan	Nutrient Mitigation Plan
24	NMP24	How am I doing?	Nutrient Mitigation Plan
25	NMP25	Select Year	Nutrient Mitigation Plan
26	NMP26	Compare Mitigation Plans from year to year	Nutrient Mitigation Plan
27	DV27	Farm visualisation	Data Visualization
28	MF28	Parcel visualisation	Manage farm
29	MF29	Define farm boundaries	Manage farm
30	MF30	Draw parcel	Manage farm
31	MF31	Adjust parcel	Manage farm
32	MF32	Delete parcel	Manage farm
33	MF33	Farm setup and administration	Manage farm
34	MF34	Add Fertilizers	Manage farm
35	MF35	Add Manure	Manage farm
36	MF36	Add Nutrient source	Manage farm
37	MF37	Edit Manure information	Manage farm
38	MF38	Add animal information	Manage farm
39	MF39	Livestock management	Manage farm
40	MF40	Edit Animal information	Manage farm
41	MF41	Add crop	Manage farm
42	MF42	Parcel Crop management	Manage farm
43	MF43	Display farm specific data	Manage farm
44	WM44	Retrieve third party solution data (FAST)	Web or mobile app
45	SDM45	Modify soil Data	Soil Data Management
46	MF46	Connect soil sample coming from a Laboratory	Manage farm
47	SDM47	Upload soil sample data	Soil Data Management
48	SDM48	Enter / Upload Soil sample Data	Soil Data Management
49	NMP49	Export Mitigation plan	Nutrient Mitigation Plan

Sort	ID	User Story	Epic
50	MMC50	Consult mitigation measures catalog	Mitigation Measures Catalog
51	PM51	Create and view road map	Policy maker
52	COM52	Manage regulations	Communication, Admin, Privacy & Legal
53	PM53	Export Roadmap	Policy maker
54	WM54	Data Request	Web or mobile app
55	WM55	Tool tips	Web or mobile app
56	WM56	Navigation	Web or mobile app
57	AM57	Language and units	Account management
58	AM58	Reset password	Account management
59	COM59	Cookie Consent	Communication, Admin, Privacy & Legal
60	COM60	Data Consent	Communication, Admin, Privacy & Legal
61	COM61	GDPR data use	Communication, Admin, Privacy & Legal
62	COM62	Delete my data	Communication, Admin, Privacy & Legal
63	COM63	Provide my data	Communication, Admin, Privacy & Legal
64	COM64	Documentation	Communication, Admin, Privacy & Legal
65	COM65	"Contact" - technical support / Nutribudget / Nutriplatform project information request	Communication, Admin, Privacy & Legal
66	WM66	Log out	Web or mobile app

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Project Coordinators:

Prof. Erik Meers, Erik.Meers@UGent.be

Dr. Ivona Sigurnjak, Ivona.Sigurnjak@UGent.be

Ghent University, Sint Pietersnieuwstraat 25, Ghent 9000, Belgium.

The Consortium:

Funded by the European Union

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