D7.3 MAA Activity and Pilot Report 1

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Contents

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1 Executive Summary

Work package 7 is responsible for establishing, supporting and facilitating Multi Actor Approach activities within DEMETER. WP7 defines a usable demand driven approach across the entire DEMETER ecosystem, using a user-centric approach to ensure all stakeholder's needs and concerns are addressed throughout the project and into the future.

This deliverable describes the MAA activities that have been planned, facilitated and delivered through WP7 to ensure a user-centric approach.

In summary, these activities include:

1. Stakeholder Workshops
2. Interviews & Surveys
3. Pilot engagement
4. Usability Studies
5. User-centric design

Furthermore, WP7 actively interact in cross pilot collaboration and dissemination and a description of how these tasks are implemented will be given. This document describes the activities that have taken place in the first half of the DEMETER project, focusing on the internal stakeholders and discusses further steps where WP7 in collaboration with WP6 begins external facing activities to reach further stakeholders.

2 Document History

Version	Author	Description
D7.3_V0.1	FhG-FIT	First Draft with TOC
D7.3_V0.2	Walton	Structure
D7.3_V0.3	FhG-FIT	Added section 6.3 – Farmer Survey
D7.3_V0.4	Walton	Executive Summary and WP structure
D7.3 V0.5	IFA	MAA in Ireland
D7.3_V0.6	FhG-FIT	MAA Activities
D7.3_V0.7	APPR	MAA in Romania
D7.3_V0.8	Walton	Updated content
D7.3_V0.9	Walton	Roadmap
D7.3_V0.10	Walton	Restructure and updates
D7.3_V0.11	Walton	Outreach and restructure
D7.3_V0.12	Walton	Conclusions and final review
D7.3_v1.0	Walton	Updates based on review

3 Abbreviations and Acronyms

Abbreviation/Acronym	Explanation
AC	Agricultural Coordination
AIS	Agricultural Interoperability Space
DL	Deliverable Leader
ICT	Information and Communication Technologies
KPI	Key Performance Indicator
MAA	Multi Actor Approach
PM	Person Month
RE	Requirements Engineering
SM	Social Media
SOCS	Stakeholders Open Collaboration Space
WP	Work Package
WPL	Work Package Leader
DEH	Demeter Enabler Hub

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5 Introduction

For the initial stage of the DEMETER project, the MAA activities focused on the internal stakeholders, Pilots, Farming Organisations, Hardware and Software providers to fully understand their needs and concerns when it comes to Agri-tech technologies and adoption.

This user-centric MAA approach focused on firstly empathising with the stakeholders through interviews, surveys and workshops. Once this information was gathered, WP7 then focused on the user facing interfaces that these stakeholders would be interacting with through DEMETER, carrying out usability and user testing on the initial releases of this software.

For the next phase of DEMETER, WP7 will focus more on reaching more stakeholders, gathering further information on how DEMETER can help to address their needs and concerns through a variety of MAA activities detailed throughout the document.

6 MAA Activities for DEMETER VISION and STAKEHOLDER NEEDS

6.1 Vision Scenario Elaboration

With respect to the co-decision approach of the MAA followed in DEMETER, Vision Scenario Elaboration workshops build a common ground for key project partners.

The workshops follow two main goals. On the one hand, they serve as a tool to build a common ground and a mutual understanding of important pillars of the DEMETER project. On the other hand, they push the internal MAA forward, in that project partners will learn about each other's goals, partners' approaches to the DEMETER project, and the intentions brought to the table by the partners and the stakeholders that they represent.

In order to develop such a common ground, WP7 conducted Vision Scenario Elaboration workshops. In these workshops, partners of the consortium develop a common vision in a co-creative manner. Concrete questions that shall be answered by the participants are:

a) For whom are we building the platform?
b) What problem(s) are we solving for our target group?
c) How can we help them in order to achieve their goals more efficiently?

After elaborating on these three questions, a Vision Scenario was formulated, that serves as a guideline for technical and non-technical partners for the rest of the project phase. A vision scenario describes a prospective future state of the platform at the end of the DEMETER project phase by describing a user scenario in a prosaic way with respect to the three questions mentioned above. The user scenario serves as a common goal for project partners to aim at during the development of the platform and will make sure that at the end of the project phase DEMETER is going yield a platform that will be viable and serves the stakeholders' needs. The vision scenario also helped with the dissemination of the DEMETER material, as it gives a concrete example of how the DEMETER platform might look like and how stakeholders are going to profit from it.

The Vision Scenario workshops were completed remotely involving key stakeholders from DEMETER.

6.1.1 Results

After the workshops were completed the following was derived as the DEMETER Vision:

The goal of DEMETER is to enable better decision making in agriculture.

In order to achieve this goal, DEMETER will be an open source data and IoT integration platform. It will serve as a market place that enables the exchange of smart-agriculture related services and serve as a knowledge base that facilitates knowledge exchange and community building. It will provide the infrastructure to make agri-data from different sources accessible, standardized and integrated, thus enabling better decision making for all stakeholders of the agri-sector.

With DEMETER,

farmers will be able to…	• Understand the importance of precision farming • improve their farming operations, thus optimizing resource usage and in return deliver higher product quality • reach better decisions, due to an increased availability of information and a large knowledge network • gather, store, integrate and make sense of data from different sources, thus reaching vendor independence • have regulatory certainty due to more insights into their own farming processes and data
the general public will be able to…	• access state of the art knowledge in the farming domain
advisory services will be able to…	• connect to a wide variety of farmers • better support the farmers with their services due to a collaborative space
SW providers will be able to… HW providers will be able to… It-services will be able to… ICT-providers…	• open up new markets • define better requirements due to an increased knowledge about the farmers and their needs • develop better algorithms and deliver more holistic solutions due to more accessibility to farmers and their data • user the information provided by other software due to enhanced compatibility • expand their network and knowledge • share the responsibility of developing solutions with other providers • abide by a defined framework
Agri-suppliers will be able to…	• offer their services in a market place to the farmers • embrace new technology, thus leveraging new technical solutions • improve and optimize their processes and production due to the richly available data
Final users will be able to…	• obtain information and learn more about the products they use • get information and transparency about the supply chain
Public authorities will be able to…	• get figures about a nations agricultural productivity due to an accessible data source

6.2 Stakeholder Workshop

6.2.1 Goals and Objectives

In order to get a deeper understanding and to identify any potential blind spots regarding the stakeholder landscape in DEMETER, a workshop series, building upon the stakeholder analysis process previously commenced in WP4 and WP5, was initiated in collaboration with WP5, 6 and 7. The goal of this workshop series is to identify all stakeholders and to "better understand and get a vivid image of the different stakeholder groups involved, their business context, needs, but also attitudes, concerns, and other characteristics relevant to the DEMETER project" as recommended by the Technical Review. The first workshop took place on the 4th September 2020 with the main objectives of identifying any missing stakeholders, building on the classification work already completed in WP5, and to prioritise the stakeholders accordingly. A selection of key stakeholders was then chosen to better understand their needs, interests, and concerns. By focusing on key stakeholders, a deeper understanding of the most important concerns, needs and interests regarding the DEMETER project was elaborated.

6.2.2 Workshop Methodology and Overview

Of the 72 registered participants 60 attended the two-hour remote workshop organised and hosted by work packages 5,6 and 7. Participants included a mixture of pilot leaders, WP Leaders and members of WP 5, 6 and 7 with expertise in the technical landscape and the communication process. In order to incorporate elaboration and validation at the same time, the workshop was conducted in a remote co-creation style involving as many DEMETER project consortium partners as possible. Zoom was used to facilitate and host the workshop. To implement a participatory approach, the collaborative online whiteboard application 'Mural' was used to collect and organise input provided by participants. This tool was tested and introduced to the DEMETER consortium on previous workshops and enables creative and productive knowledge and idea co-creation with multiple contributors. After a short introduction of the agenda and the goal of the workshop a warmup game was conducted to familiarise each participant with the remote co-working space 'Mural'. As the 60 participants are stakeholders of the DEMETER project, they were asked to firstly categorise themselves in one of the generic stakeholder classes already identified by WP5 and provide details in a short discussion. This first exercise was carried out in order to clarify the term 'stakeholder' and to briefly state the stage of development in the overall DEMETER stakeholder analysis process. Furthermore, this warmup provided room to solve technical issues.

Figure 1 Mural Warm Up Exercise

Participants were then divided into three Zoom breakout rooms which were facilitated by two members of work packages 5,6 and 7 each. Participants were split randomly into the three groups working on one of three parallel sessions. The sessions were timed to about 45 minutes and organised in a timeboxing manner which ensures fast but creative replies. Three tasks were prepared on a collaborative Mural whiteboard with a set timing of 15 minutes each. In the first task participants were asked to brainstorm and identify as many stakeholders as possible also keeping in mind the generic stakeholder classes defined in previous work. The findings were arranged, filtered, and discussed to clarify, cluster, and remove doubles. In the second task participants were asked to classify the stakeholders in an influence-interest matrix which is a key step in the stakeholder analysis and management process. The goal of this task was twofold. On the one hand, the outcome is a visual representation of a stakeholder map which allows identification of key players but also less important stakeholders regarding the DEMETER project. This approach reveals information on how particular stakeholders are best managed and gives indications on which stakeholders should be managed more closely compared to others. On the other hand, this task raises awareness of the stakeholder management and engagement process itself in the project consortium. In preparation of the third task participants conducted a dot voting (a democratic voting process where participants express their favour of an idea by casting votes via little dots) and identified the five most relevant stakeholders in each breakout room. The focus on five key stakeholders allowed a more detailed analysis on their needs, interests, and concerns during the third task. Comparable to task one, in a mixture of brainstorming, brainwriting, and open discussion every participant was asked to brainstorm needs, interests and concerns for each of the five key stakeholders in relation to DEMETER. Some stakeholders were represented by participants (for example pilots for a particular farmer) which allowed detailed insights into their specific needs, interests, and concerns. The first DEMETER stakeholder workshop was closed with a short feedback session on the workshop itself and proposals for future actions.

6.2.3 Findings

The information from the three mural boards across each of the breakout rooms was then consolidated to one board. Duplicates were removed and unclear inputs were removed. When necessary, stakeholders were specified as well as possible. The mural board was transformed to an excel sheet and consolidated with previous results of the DEMETER stakeholder analysis process.

Figure 2 Example of Mural Board from Breakout Room

6.2.3.1 Stakeholder Identification

As mentioned, the stakeholder analysis built upon the previous work carried out by WP5 in comprehensively identifying stakeholder groups as outlined in Table 1.

Table 1 Stakeholder Identification

Generic Stakeholder class	Definition
Farmer	This can be a single person, a cooperative or an association, engaged in agriculture, raising living organisms for food or raw materials.
Software Provider	This can be a single person, a company or an association providing software solutions, tools, components, algorithms (if packaged as a software component).
Hardware Provider	This can be a single person, a company or an association providing hardware solutions, such as smart meters, sensors, VRA machines, irrigation valves, milking robots, ...
Agri Suppliers	This can be a single person, a company or an association providing things like feed, seeds, fertilisers, pesticides, fungicides, ...
IT Services	This can be a single person, a company or an association providing services like software integration, data-, processing- or cloud-services.
Advisory Services	This can be a single person, a company or an association providing advisory and consultancy to farmers in terms of rules and regulations, including training to farmers, quality supervision services, lobbying associations, …
Public Authorities	This can be public authorities such as governments, municipalities etc.
General Public	you and me.

To delve deeper into these defined groups, attendees listed all the stakeholders under each group heading. This covered the full range of existing users, potential users and interested parties. A full description of each of the stakeholder groups, the main stakeholders within the group and a definition is outlined in Table 2 below.

Table 2 Refined DEMETER Stakeholder Group Description

Stakeholder Group	Main Stakeholders	Definition
Farmer	• Large, small, male, female, dairy, livestock, maize, rice, olive, potato, poultry, pig, progressive (early adopters), pilot farmers • Farm manager/owner, farm families, farm employees • Farmer Cooperatives, Farm Purchasing and Producer Groups • Farmer Organisations, Fruit Growers' Associations	The farmer stakeholder group can include individuals or groups raising living organisms for food or raw materials. This group can be broken into the type of crop or livestock that is farmed and segmented further to employees and families that would be interacting with software and hardware on a daily basis. Progressive, early adopters are noted as a separate stakeholder as they are the usually first to try new technology and help to disseminate information with their peers. Female farmers are also identified as a specific target group as the rate of agricultural technology adoption is lower among women than men (Huyer, 2016).
Software Provider	• Mobile / Web / AR / AI app providers • Data management and visualisation tool providers • ERP provider • Analytics service provider • FMIS vendors • System integrators • SMEs in the Open Calls	A software provider can be a single person, a company or an association providing software solutions, tools, components, algorithms (if packaged as a software component) that can be integrated with the DEMETER HUB. Different software providers will have different interests in elements of the DEMETER HUB.
Hardware Provider	• Ag machinery providers – large industry and small industry • VRA machinery providers • IoT, Drone, Sensor & Robotics providers & Weather station and field sensor providers • Comms provider (telco) • Smart irrigation system providers • Satellite providers	This can be a single person, a company or an association providing hardware solutions, such as smart meters, sensors, VRA machines, irrigation valves, milking robots that can be used and integrated with the DEMETER HUB.

Stakeholder Group	Main Stakeholders	Definition
Agri Suppliers	• Agro chemical for crop providers • Feed & nutrient providers for animals and land • Irrigation manufacturers • John Deere Machinery • Water supply providers	This can be a single person, a company or an association providing things like feed, seeds, fertilisers, pesticides, fungicides and machinery. Machinery can communicate with the DEMETER HUB and data from other Agri-suppliers can be corelated through the HUB also.
IT Services	• Cloud provider • Agri datacentres • Comms service provider • Mapping services • Supply chain system integrators • Validation/certification authorities • Weather data providers • DLT service provider	The IT Services stakeholder group can be a single person, a company or an association providing services like software integration, data-, processing or cloud-services to the DEMETER HUB. This stakeholder group plays an important part in the architecture and data provided to the DEMETER HUB, providing real time data and systems to provide a reliable system.
Advisory Services	• DIH • Farm agents • Rural advisory services • Agri researchers • Group associations • Academics	This can be a single person, a company or an association providing advisory and consultancy to farmers in terms of rules and regulations, including training to farmers, quality supervision services, lobbying associations and research based on the data and findings. Digital Innovation Hubs play a key role in disseminating the importance and need for the DEMETER HUB, whereas farm agents and advisors are positioned to train and consult on its use. Agri researchers and academics play an important role in disseminating the results through their research and providing valuable information to the DEMETER HUB.

Stakeholder Group	Main Stakeholders	Definition
Public Authorities	• European Commission • Local Authorities/Governments • Food associations • Legislators • Environmentalists & NGOs • National/Regional Policy makers • Open DEI • Agri-tech related EU projects	Public authorities such as governments, municipalities etc. provide a platform to disseminate DEMETER data and also a way to look for future improvements and integrations through collaboration with other Agri-tech related projects.
General Public	• Consumers • Dieticians • Investors • Consumer Associations • News & Media organisations • Retailers • Teachers • Academic Community	From the stakeholder workshop, new stakeholders from the 'general public' category were identified. The general public group is spread across different categories as they may not have direct contact with the DEMETER HUB, however they will have interest and influence in the results provided.

6.2.3.2 Stakeholder Interest and Influence

Following identification of the stakeholders in the Stakeholder Analysis workshop, participants were asked to map the stakeholders identified into four distinct positions on an 'Influence/Interest Matrix for Stakeholder Prioritisation' as outlined in Figure 2. The Influence/Interest Matrix categorises the stakeholders based on their influence and their interest in DEMETER. Influence indicates a stakeholder's relative power over and within a project. Interest refers to how interested the stakeholder is in the project succeeding. Plotting the stakeholders on the matrix helps to indicate the type of action required to engage these stakeholders. It is noted that stakeholders move around the grid over time, therefore it is necessary to conduct regular analysis across the project duration.

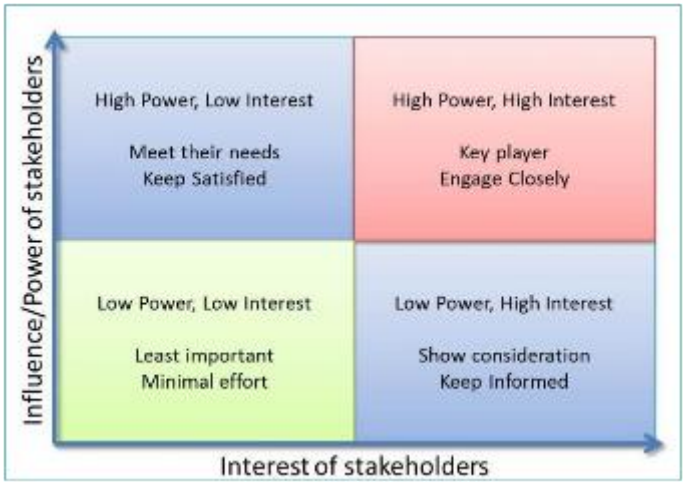

Figure 3: Influence and Interest matrix

At this stage in DEMETER (M13), the stakeholders are categorised as follows:

- **High Influence and High Interest**: In the context of DEMETER, farmers, farmers' organisations, software providers, hardware providers and advisory services were identified. These stakeholders should be managed closely and be fully engaged, making sure they are very satisfied with the level and quality of communication.
- **High Influence and Low Interest**: For DEMETER, media associations, legislators, validation / certification authorities, logistic companies, local governments and some categories of software and hardware providers were identified. These stakeholders should be kept satisfied but not bored with the message. Some stakeholders categorised in this group are recognised as being of the cusp of the 'High influence and High interest' group.
- **Low Influence and High Interest**: In the DEMETER context, food producers, veterinaries and other H2020 projects were plotted in this quadrant. These stakeholders should be kept adequately informed as they might contribute with important aspects and advice. Some stakeholders categorised in this group are recognised as being of the cusp of the 'High influence and High interest' group.
- **Low Influence and Low Interest**: For DEMETER, the general public fall mainly under this section such as teachers, consumers, retailers, food associations, consumer associations, etc. They should be monitored and receive relevant updates but no excessive information. General communication such as the newsletter and website are important. The aim is to move these stakeholders into the 'Low Influence and High Interest' category.

6.2.3.3 Stakeholder Needs and Concerns

Each of the stakeholder groups located in the 'High Power and High Influence' quadrant of the 'Influence and Interest matrix' were explored further to better understand their needs, interests, and concerns and why they need DEMETER. This is important as it determines the messaging required to engage these relevant stakeholders groups and individuals. Figure 4 demonstrates the work carried out by some of the Zoom breakout rooms

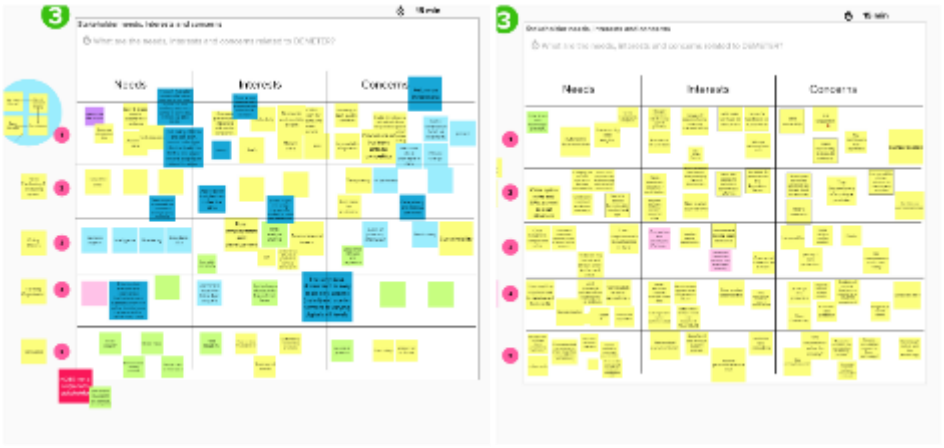

Figure 4: Mural Breakout Rooms exercise on DEMETER stakeholder needs, interests and concerns

Table 3 below outlines the results for farmers and farmers' organisations.

Table 3 Farmers and Farmer Organisations' Needs, Interest and Concerns

Farmers' Needs, Interests and Concerns and why they need DEMETER	
Larger Scale Farms	• Frequent frustration recording, retrieving, and accessing farm-level data and information due to lack of interoperability and data silos. • Preparing for an inspection or audit is a complex activity data and records spread across multiple systems and data formats. • Not being able to project, plan, model, or budget optimally due to limited or multiple different analytical and reporting systems. • Merchants have access to analytics and are able to run reports easily which makes price negotiations an unequal scenario in particular when settling payment.
Smaller Scale Farmers	• Currently, no access or limited access farm-level data and information due to lack of interoperability and data silos. • The stress of preparing for an inspection or audit is compounded by lost records and ad-hoc record keeping across multiple systems and data formats. • The opportunity cost of not being able to project, plan, model, or budget effectively due no data, flat files and data stored in siloed locations. • Merchants have access to analytics and are able to run reports easily which makes price negotiations an unequal scenario in particular when settling payment.
Smaller/Local Farmer Purchasing & Producer Groups	• Frustration aggregating data across group members. • Better data sharing and governance capabilities. • Not being able to project, plan, model or budget for group purchasing or marketing and sales activities due to limited or multiple different analytical and reporting systems. • Merchants have access to analytics and are able to run reports easily which makes price negotiations an unequal scenario in particular when settling payment.
Farmer Co-operatives	• More targeted and timely support to co-op members due to better access to member data. • Better data sharing and governance capabilities. • Procurement foresight and budgeting moving towards Lean/JIT procurement through access to aggregated data via DEMETER. • Better marketing due to greater insights into production levels and activities, seasonal sensitivities etc.
Farmers' Organisations & Associations	• DEMETER will cater for farmers of all sizes, income levels, production systems and digital capabilities for the betterment of the industry as a whole. • Macro and sectoral analysis of data trends for more effective lobbying and policy formation. • Development of digital skills programmes based on farming data.

Table 4 outlines the results for Software Providers, Hardware Providers and Advisory Services

Table 4 Software Providers, Hardware Providers and Advisory Services

	Needs, Interests and Concerns and why DEMETER is needed
Software Providers	• Opens up new markets – the total addressable market (TAM) is 11 million farmers. • Unparallel access to a currently lowly digitalised sector. • DEMETER will allow for new levels of interoperability allowing for quicker development, testing and deployment of software solutions. • Access to key players within the agricultural ecosystem including farmers, farming organisations, large machinery and equipment organisations and research organisations. • Development and R&I can be more directed through access to emerging farmer requirements and feedback. • Abundance of data to develop, test and build AI/Machine Learning solutions.
Hardware Providers	• DEMETER offers a new route to market, not traditionally available. • DEMETER offers all types of farming systems, farming conditions, farming topologies to trial, refine and deploy hardware. • Access to key players and insights within the agricultural ecosystem including farmers, farming organisations, large machinery and equipment organisations and research organisations. • DEMETER will allow for new levels of interoperability allowing for better situational testing and development, of hardware. • Ability to access different networks (Narrow Band IoT, LoRa Wan etc.) and communication protocols expanding the reach of hardware solutions. • Development and R&I can be more directed through access to emerging farmer requirements and feedback.
Advisory Services	• More targeted and timely support to co-op members due to better access to member data. • Better data sharing and governance capabilities. • Better collaboration between advisory services (regional and inter-regional) • DEMETER combines advisor knowledge and new data-insights to achieve better results for farmers. • Advisors can reference DEMETER pilots to illustrate the value of digital ag across different farming systems to their farmer clients. • Abundance of data (aggregated and anonymised) for benchmarking and conducting research projects. • Access to key players within the agricultural ecosystem including farmers, farming organisations, large machinery and equipment organisations and research organisations.

6.3 Farmer Surveys

Farmers are the most important stakeholder group for the DEMETER project. Hence, building on top of the stakeholder workshops, this stakeholder group was examined in more detail. After having identified several needs and concerns, it was important to find out what priority farmers give to those needs and concerns to understand the weight that they have in the farmers' decision making.

In total, 29 responses from DEMETER farmers were received, of which 90% were male and 10% female. The median age of respondents was 30-39 years. The geographic location of responses was spread across the EU including Belgium, Czech Republic, Georgia, Germany, Greece, Italy, Montenegro,

Poland, Romania, Serbia, Slovenia, and Spain. Almost 80% of farmers were educated to university degree level. In terms of farm ownership 69% of respondents were operating in a family farm, followed by 14% who work in a corporate farm. Only 21% of responders were part of a cooperative but 55% were part of a farmers' organisation.

Respondents were from a mix of agricultural sectors: fruit and vegetable production (grapes, apples, nectarine, blueberry, potatoes, olives, gherkins), livestock (dairy, pigs, and poultry), arable crops (maize, rice, and cereals) and beekeeping.

The farm size was mixed with 31% of respondents indicating a farm size of less than 5ha, 28% from 5 to 19.9ha, 10% from 20 to 49.9ha, 3% from 50-99.9ha and 28% had a farm 100ha or over.

Internet connectivity varied across farms; almost 30% of respondents thought it was excellent, 24% very good, 29% good, 10% poor and 7% very poor. Relating to the connectivity, the download speed or bandwidth of the internet connection varied considerably across respondents.

We firstly assessed our DEMETER farmers' understanding of the DEMETER project. 87% of respondents either agreed or strongly agreed that they understand what DEMETER is trying to achieve. 80% either agreed or strongly agreed that they would feel comfortable explaining the DEMETER project to others. 51% would like to see more information from us to understand DEMETER and its goals. Following on from this insight, we will be creating and publishing more regular information targeted at farmers and making it available in languages other than English.

Figure 3 Survey Overview

Next, we addressed farmer needs by creating a series of statements, developed in consultation with the World Farmers' Organisation (WFO). Many of these statements were also uncovered at the DEMETER Stakeholder Analysis workshop which was conducted in 2020. Farmers were asked to rate these needs on scale of 1-10 in terms of how important they considered them for their farm. Results showed that besides an *increase in yield quality*, famers ranked *access to weather and climate change information, access to feasible and affordable technology* and *accessibility, security and comprehensiveness for their farm's data* among the top five needs.

Table 5 Ranked Needs

Rank	Need statement	weighted average rank
1	... to increase yield quality.	8,38
2	... to have access to weather and climate change information.	8,28
3	... to have access to feasible and affordable technology (provided by DEMETER).	8,03
4	... my farm's data to be accessible, secure, and comprehensive for me.	7,86
4	... a system that provides me with support for maximise profit.	7,86
6	... a system that provides me with support to increase my farm's economic sustainability.	7,83
6	... a system that provides me with support to increase my farm's ecological sustainability.	7,83
8	... automated documentation of my farm's operations.	7,55
8	... to have access to market information.	7,55
10	... to increase yield output.	7,38
11	... be involved in the strategic development of innovations from the beginning of the process.	7,31
12	... to optimise input usage.	7,00
13	... to compare my farms performance to the performance of other, similar farms.	6,97
14	... access to extension services (advisory services).	6,96

Equally, a series of farmer concerns was also created in consultation with the WFO and following the DEMETER stakeholder workshop. The results demonstrated *that data privacy and sovereignty* and *the return of innovation investments* rank among the highest concerns for the DEMETER farmers.

Table 6 Ranked Concerns

Rank	Need Statement	Weighted average
1	... about my data privacy and sovereignty	5,03
1	... that I invest in an innovation that doesn't give me the proper economic return	5,03
3	... to disclose my business data to my competitors	4,93
4	... that my competition is ahead of me	4,52
4	... that I invest in an innovation that doesn't fit my needs	4,52
6	... that I invest in technology that is not compatible with my other technology	4,38
7	... that I do not have the necessary skills to use or operate the new technology	4,31
8	... that the technology I invest in is outdated	3,79

We then looked at the perceived usefulness and perceived ease of use of the DEMETER technology. These questions were structured using a 5-point Likert scale where 1= Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4=Agree, 5= Strongly Agree.

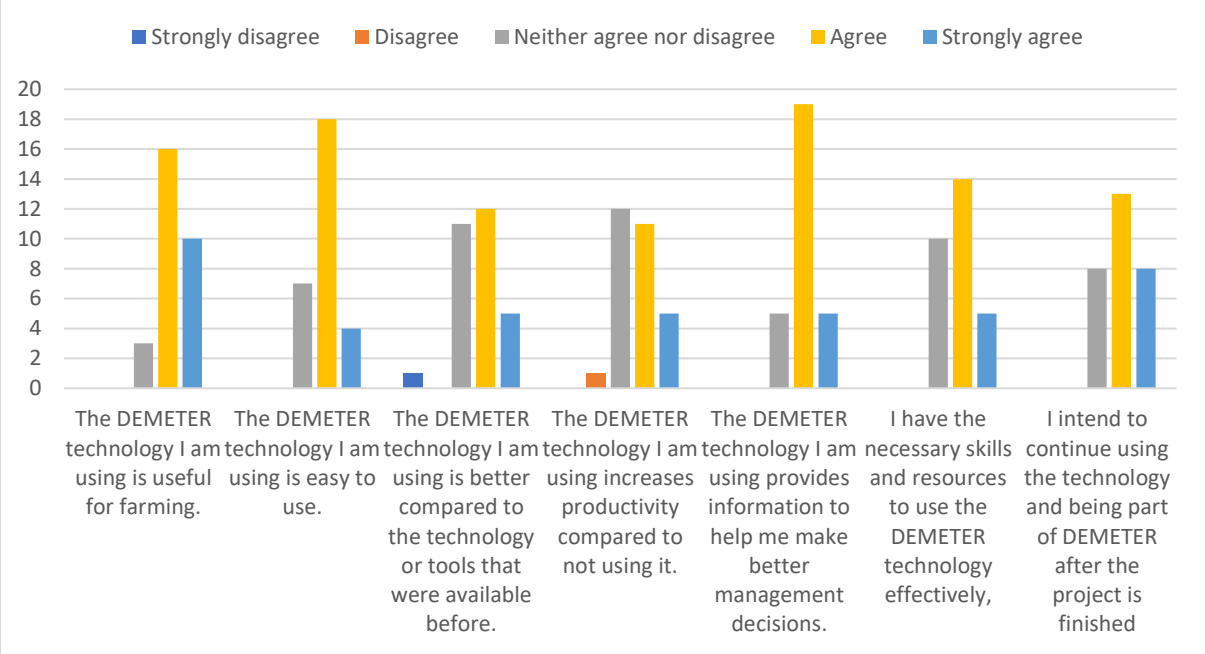

Figure 4 Usefulness of DEMETER Results

Finally, respondents were asked to rank the greatest innovation needs in agriculture in their country. Education and Skills represented the most important area, with an average ranking of 3.21, with one respondent commenting that "Training for farm workers is important for all innovative technologies. Otherwise, they won't apply". This was followed by *enabling framework (financing and banking schemes, legal framework etc.)* and *digital infrastructure*, both with an average ranking of 2.32, and physical infrastructure with an average ranking of 2.21.

In summary, the survey was a very useful exercise to better understand farmers' needs, interests and concerns regarding digital technologies and the DEMETER project. It enriched qualitative insights that were generated by the DEMETER consortium beforehand with quantitative data, thus guiding the DEMETER research to further directions.

As for needs and concerns, topics like *accessibility* of both *climate data* and *technology*, as well as *data security and sovereignty* will be addressed in further workshops.

The results will help us address these issues and improve our communication with the farming community. We will be extending a similar survey to a wider network of farmers over the coming months. In addition, we will be creating a survey to engage with IT service providers (hardware and software).

6.4 Use Case Interviews

As it is described in deliverable D5.4 in section 5.1, eight interviews with at least one farmer or close representative per pilot cluster were conducted. Aim of these interviews was (1) to derive overarching and authentic non-technical needs and requirements, (2) to get deeper insights into the context and working environment from the farmer's perspective, and (3) to define at least three user personas which represent different archetypes of the user group "farmer". Results related to (1) and (2) are described in D5.4 in section 5.1 and 5.2. Results regarding the goal and scope of the derived personas are described in the following section.

6.4.1 Methodology and results

The farmer perspective was chosen as it is expected to be the largest and most diverse and therefore arguably the most important end-user group of the DEMETER platform. The qualitative exploration of user context and working environment is conducted following DIN ISO EN 9241-210 by exploring the farmer's point of view in semi-structured interviews. In combination with various information sources (e.g. stakeholder workshops, pilot experience maps, vision scenario) generated in former MAA activities, a set of stakeholder needs and non-technical requirements was derived. Details on the requirement analysis process and results are described in deliverable 5.4 in sections 3.3 and 5.

Eight farmers or close representatives (in the following referred to as farmers) with appropriate knowledge in farm management and technology were recruited for the interviews. Following the MAA approach farmers involved in the DEMETER project as well as farmers not directly involved in DEMETER were interviewed. The interviewees work in different positions, ranging from managers of large-scale farms (>100 hectares of farmland) to farm workers operating very small-scale farms with less than two hectares of cultivated farmland. The heterogeneity of the user group is further emphasised through the different farm types (e.g. characterised by cultivated plants or type of livestock farming), geographic location, climatic conditions, fragmentation of land, local regulations, attitude and utilisation of digital technologies, openness for innovation, and further characterisation factors.

In general, these variations lead to a variety of specific challenges that farmers in Europe are facing. However, to a certain extent general user needs and non-technical i.e., user and organisational requirements can be derived as it is presented in deliverable 5.4 in section **Error! Reference source not found.**.

General overarching non-technical challenges (besides increasing yield quality/output and maintaining economic sustainability) directly derived from the farmer interviews include *technology acceptance, usability issues, internet connectivity, expert knowledge and field-specific recommendations* and *consequences of climate change.* Detailed explanations of these challenges can be found in deliverable 5.4 in section 5.3.

The following table provides information about the interviewed farmers and an estimation of the ICT-utilisation level based on the interviews.

Table 7 Interviewed Farmers' estimation of ICT utilisation

Cluster	Location	Farm scale	Farm type	Position	Main challenge	ICT utilisation
1	Spain	Large scale	Crops	Management of several farms	Irrigation Management, Interoperability	High
2	Germany	Large scale	Crops	Farm owner & manager	Determination of fertilisation requirements & Job cost analysis	Middle
2	Germany	-	-	Research & development of agri-tech-nology	Job cost analysis and optimisation	-
3	Greece	Small scale	Olives	Farm owner	Decision support & knowledge transfer	Low
3	Greece	-	-	Research & development of agri-tech-nology	-	-
4	England	Middle scale	Dairy & livestock farm	Research & Farm manage-ment	Dairy cow health and well-being improvement	High
5	Montenegro	-	-	Research & development of agri-tech-nology	-	-
5	Montenegro	Large scale	Vineyards	Farm management	Disease prediction	High

The qualitative assessment of the user context and the evaluation of information about the behavioural factors of farmers in Europe was conducted based on the method of semi-structured interviews[1]. After gaining insights into the general context (e.g. farm type, farm scale, general information about location) that the interviewees are embedded in, the farmers and close representatives were asked to frame their current main challenges and their solution approach step by step regarding their day-to-day work. Questions aiming to analyse their motivational drive and emotions were asked. During the entire interview, feelings and potential pain points were noted by the interpretation of the narrative by a usability expert.

The information extracted from the interviews were synthesised in three personas which describe the mentality and behaviour of farmers. The personas represent different variations of typical farmers in Europe and aim to provide an overview of the variety of personalities and environments farmers are embedded in. The personas support developers to gain insights into viewpoints and angles of farmers.

[1] Döring, Nicola / Bortz, Jürgen (2015): Forschungsmethoden und Evaluation in den Sozial- und Humanwissenschaften. Berlin Heidelberg New York (Springer-Verlag).

They do not aim to represent real persons but to provide a variety of different motivational and behavioural aspects of farmers. These personas are available in Annex A.

6.5 User Requirements Analysis

As described in D5.4 “Revised Stakeholder Requirements, Pilots Design, and Specification”, based on the MMA activities carried out in WP7, a list of stakeholder needs was developed. Derived from this, the so-called non-technical i.e., stakeholder needs, and requirements serve to support the ongoing generation and refinement of the technical requirements (by WPs 2, 3, 4). The activities in question are mainly the stakeholder workshop (Section 6.2 of this deliverable) and farmer survey (Section 6.3) as well as the use case interviews with farmers (Section 6.4). In this way, the needs and requirements gathered in WP7 are of an overarching, non-pilot-specific nature, whereas the pilots conduct their own outreach and farmer engagement to derive pilot-specific requirements.

The stakeholder needs were derived in line with the established Usability guidelines and the ISO norm 9241-210:2019 “Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems”. Human-centred design aims to make interactive technology useful and usable by focussing on end-users’ needs and requirements.

The list of needs was derived in the form of user stories in the form of, e.g. “As a *farmer*, I need to increase my farm's ecological sustainability.” or “As a *technology provider*, I need to have information on and access to interoperable and standardised data”. Generally, with needs, the analysis is still detached from the solution space and considers solely the problem space (see Figure 6). These needs describe each a condition or prerequisite that fulfils a specific purpose regarding the task, or they capture overarching goals and interests of the stakeholder group. They contain a user story and do not specify the reference of the requirement yet.

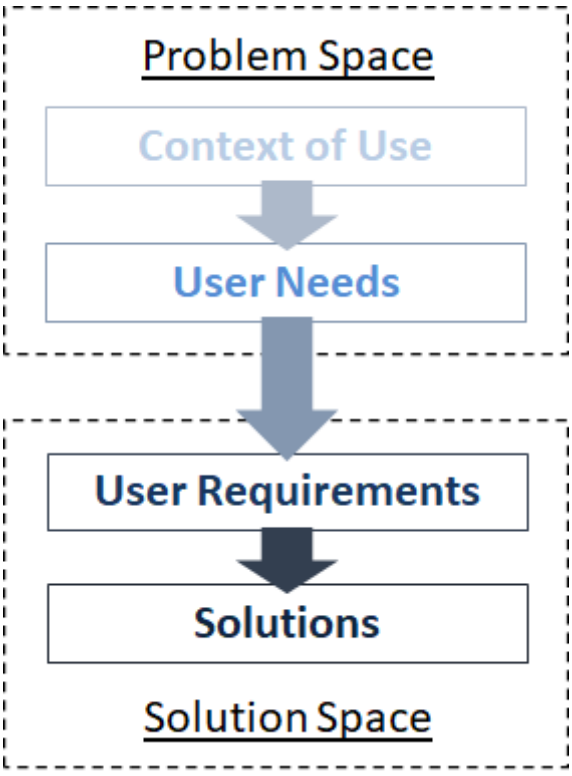

Figure 5 Problem and Solution Space

Therefore, from the stakeholder needs, concrete, specified user and organisational requirements could be derived. User requirements tap into the solution space (see Figure 6) and specify the action that needs to be supported by the system or the information that needs to be provided. However, the description is agnostic of any specific technology (other than technical requirements are) in the form of, e.g. “The user needs to discern the level of his/her farm's ecological sustainability on the system”.

In contrast, organisational requirements do not take the end-users’ perspective in terms of direct system interaction but are rather broad and focus on an organisational goal or outcome that must be ensured, thereby specifying the appertaining stakeholder group, e.g. “The farmer needs to ensure the increase of his/her farm's ecological sustainability.” The list of stakeholder needs, user requirements and organisational requirements can be found in D5.4 and its annex. Moreover, the list has been included in the project-overarching requirements management board in GitLab on the basis of which the different levels of requirement are being coordinated and synchronised.

Ultimately, both user and organisational requirements along with others (e.g. functional, legal, business) constitute the requirements specification, which provides crucial information for the development of the technical requirements as the functional specification to meet the former. Those non-technical stakeholder requirements are not specific for each individual pilot but concern a more overarching level of analysis that is relevant for the whole DEMETER technical environment including and especially the SOCS, which is where the two stakeholder / end-user groups interact – farmers and technical developers. Rather, the pilot-specific user requirement analysis is carried out in WP5 (see D5.4). In order to monitor that requirements analysis process, WP7 will prospectively focus on an involvement in this regard, ensuring the proper gathering of information from the pilot’s end-users for deriving pilot-specific user requirements. For that purpose, workshops with pilot representatives will be held.

6.6 KPI Workshop

To achieve a better understanding of goals and key performance indicators (KPIs) for all pilot participants a virtual co-creation workshop was designed and delivered. For this workshop Mural was selected as the most ideal platform to deliver to interactive session as it:

1. Allows for multiple boards to be used
2. Closely reflects the process used in physical, face-to-face sessions
3. Follows the same principles that participants are accustomed to; sticky notes and voting polls.

The second tool needed to deliver the workshop was an audio-visual tool, for this we chose Zoom as it:

1. Can be used simultaneously with Mural
2. Allows for multiple users at a time
3. Has audio and video recording capacity
4. Can host break-out sessions (small groups of 5 – 10 people) which is ideal for group sessions in the workshop.

The Workshop started with a presentation which introduced the facilitators and outlined the above tools and how to use them. The next section outlined the important differences between goals and

KPIs and finally how to create KPIs based on pilot goals using the SMART principle. The acronym SMART was first introduced in an article entitled “There’s a S.M.A.R.T way to write management goals and Objectives” (G. Doran et. Al , 1981) and can be described as follows:

- Specific: What needs to be achieved? And by who?
- Measurable: How will this be measured?
- Attainable: Can the KPI be fulfilled with the tools that you have?
- Realistic: Can this KPI actually be achieved?
- Timely: What is the timeline of this?

The presentation delivered is an important aspect of the workshop as it allows participants to achieve the correct mindset before the interactive section starts.

The first section of the interactive workshop started with an introduction to the tool being users, Mural and Zoom, which included an overview and warm-up exercises to introduce the main functionalities of the tools and give time for any technical questions.

Once the warm-up was completed, the participants were randomly assigned to 2 breakout rooms with Zoom, each having a facilitator to introduce the next section of the workshop. Participants were randomly assigned to achieve a mix of goals and KPIs in each breakout room.

Each breakout room received 3 identical exercises.

6.6.1 Your Goals

This was a timed exercise where participants were given 8 minutes to list at least 2 pilot goals each. Once the timer was complete, the goals were grouped by the facilitator and a voting session was started. The participants were given 5 votes each to distribute across the goals which they felt were most important to the pilots. After 2 minutes the votes were totalled, and the top goals were then copied to the next exercise. (Creating KPIs)

6.6.2 Creating KPIs

SMART KPI setting was introduced again here and the participants were encouraged to discuss the tops goals from the previous exercise to create SMART KPIs, each KPI created had to be Specific, Measurable, Attainable, relevant and Time Sensitive. This exercise was timed and completed within 15 minutes.

6.6.3 Defining KPIs

The final exercise was to list the KPIs based on the work in the previous 2 exercises, this allows the participants to create well-structured and attainable KPIs to work towards in the future.

Once all the exercises were completed, the Zoom break-out rooms were closed and all participants re-joined the main room and discussed the findings. Participants noted that this was a useful exercise to get them thinking about KPIs in the correct framing and that they would use the principles learned to refine the KPIs that they use to measure success on their pilots.

6.6.4 Results

Goals	KPI's
Pilot 1.3: Minimize the risk for salt toxicity in rice fields.	[Pilot 1.3] Water conductivity that exceeds (at any point in the growing season) 3 dS/m, decreased in less than 6 hours, by June 2021 for any in any DEMETER-monitored rice paddy.
Pilot 1.3: Improve farmer's net profit	[1.3] net profit increased more than 20% due to DEMETER services, by October 2022.
Pilot 1.3, 1.1, 1.2: Automate the whole irrigation workflow in arable crops	[1.3] Rice grower time on the field for irrigation decreased by more than 90% during the growing season, by October 2022.
	[1.1/1.2] Increase the awareness of water & energy savings to 20.000 hectares.
	[1.1, 1.2] Increase the number of interchange experiences and training activities by 10% in 2020.
	[1.1/1.2] To link Pilot Platform with Outcomes of OC1 in 2022.
	[1.4] Rationalize maize production costs by distributing the inputs with variable rate and reducing the costs.
	[1.4] Determine plant stress with the help of the unsupervised classification of NDVI pixels images.
	[1.4] Better Nutrient management by analysing the historical images on the same plot for the last 5 years.
	[1.4] establishing the optimal fertilization period based on the weather forecast.
Pilot 2.1 collect new data (in terms of new parameters/attributes)	[2.1] Increase number of collected data parameters/attributes by X (X is maybe 5 or 10), by end of the project.
Pilot 2.1 work with new data to present new information to user	[2.1] provide dashboard containing information about the new collected data (e.g., how the data looks like in comparison to "the perfect situation" and regulations) by end of the project.
Pilot 2.2 Reduce time spend on documentation	[2.2] Reduce time spent on documentation to 25% by October 22.

Goals	KPI's
	[2.2] Reduce time on job cost calculation up to 25% and enables cost monitoring through geospatial visualization (map).
Pilot 2.2: enables cost monitoring for field operations (fertilization and spraying application)	
Pilot 2.2: enable farmer to gain insights from the data they are collecting over the season	
Pilot 3.4: increase sharing of data (find data, use standards)	[3.4] serve detailed potato yield data to at least 3 external parties by end of 2022.
Pilot 3.4: increase use of IoT to gather training data for ML models	[3.4] have 15 AVR harvesters in operation that can measure yield by end of 2022.
	[3.4] have soil sensors in place at least for 15 fields by end of 2022.
	[3.4] have at least 3 external users for VITO & apos; Sentinel-2 products (AIM format) for farming purposes by end of project (2023)
Pilot 3.4 increase potato yield at lower costs	[3.4] increase potato yield with 3 tons/ha (compare to year with similar meteo conditions) by end of 2022 at no extra costs
Pilot 4.1 Effective farmers	[4.1] Increase net profit for milk farmers by 5 % in the end of 2022
	[4.1]. Reduced costs of production by 5 % in the end of 2022
Pilot 4.1 Knowledge-based choices	[4.1] reduce data managing costs for farms by 10 % in the end of 2022
Pilot 5.1 Share experience with other farmers (also 1.1, 1.2)	
Pilot 5.1 To optimize resource usage	
Pilot 5.1 To use modern technologies in Agriculture	

Goals	KPI's
Pilot 5.1 To increase farms & apos; sustainability	
Pilot 5.1 Awareness raising on modern equipment	
Pilot 5.1 To improve product quality	
Pilot 5.3 To protect bees due better communication between farmers and beekeepers	
Pilot 5.3 To optimise pollination due better communication between farmers and beekeepers	
All farmers: Improve digital skills for farmers	
All farmer: Showcase technology benefits	
Pilot 4.2: Monitor animal welfare	[4.2] Number of animals per square meters.
Pilot 4.2: Improve transparency	
All farmer: Strengthen farmer collaboration	
Pilot 3.1: Optimal use of fertilizer, water and crop protection products	

6.7 Co-creation Workshops

The DEMETER pilots are used to demonstrate and evaluate how innovations and extended capabilities benefit from the interoperability mechanisms and integrate with the set of DEMETER core enablers. The core enablers are needed for creating any DEMETER applications and thus mandatory for any interested stakeholder who wishes to expose or share his/her own resources.

Based on feedback collected in individual interviews with each of the pilots, it became apparent that frequent cross-pilot and cross-work-package interactive sessions would provide a major improvement from a coordination as well as progress perspective. A series of online workshops focusing on DEMETER ecosystem deployment have been organized by WP5 and WP7 with the objective of bringing together enabler providers, the technical work packages, enabler users, and the pilot developers who integrate the enablers in their pilot. With up to 80 participants from the pilots and the technical work packages attending the first workshop, this concept will further enhance intra-project communication and interaction. The workshop series is described in more detail in D5.5.

The workshops are structured into three parts with different respective focuses:

- Part 1 is centred on general needs, concerns, experiences, and open issues. Each pilot briefly presents their status and current experiences during development. Questions are answered

directly in the meeting and on a Mural board. Mural is an online tool that enables visual collaboration, and participants can post their needs, concerns, and the proposed actions to be taken to support them regarding the enablers they are currently and prospectively using.

- Part 2 of the workshops focuses on technical issues, again with the help of a Mural board which includes an issue tracker in which issues from the pilots can be collected; clustered according to the categories: bug, high priority, discussion, and enhancement; and answered by the technical support team. The discussion in the workshops focuses on different demonstrations of the pilots, sharing examples of their work to further showcase the integration of the DEMETER enablers.
- Part 3 is the so-called "genius bar" and designed to allow specific issues and users to share their screens to demonstrate any open issues that they may have encountered. This results in a very productive open discussion on the technologies being utilised and tools to allow users to track and record tasks.

In these workshops, pilots are encouraged to present the status of the DEMETER enablers' integration and demonstrate the current status. Technical partners demonstrate to the pilots how to integrate the core DEMETER components, and how to expose pilots' assets and resources by means of the DEMETER enablers, through overviews of the installation steps, and live integration walk-throughs. This co-creation workshop series was identified as a useful session that the participants are eager to continue on a regular basis.

The initial phase of the MAA activities concentrated on the internal workings of the DEMETER ecosystem and the stakeholders involved, e.g. the farmers for whom the pilot solutions are build. From month 23 to month 42 MAA activities will mainly focus on further reach to external stakeholders while supporting the role out of the DEMETER technology. In that regard, the pilots have committed before the onset of DEMETER to reach out to a certain number of farmers.

6.8 RoadMap

A full roadmap can be seen in the following image outlining the process. Many of these activities are described in this deliverable in detail. Others are outlined below.

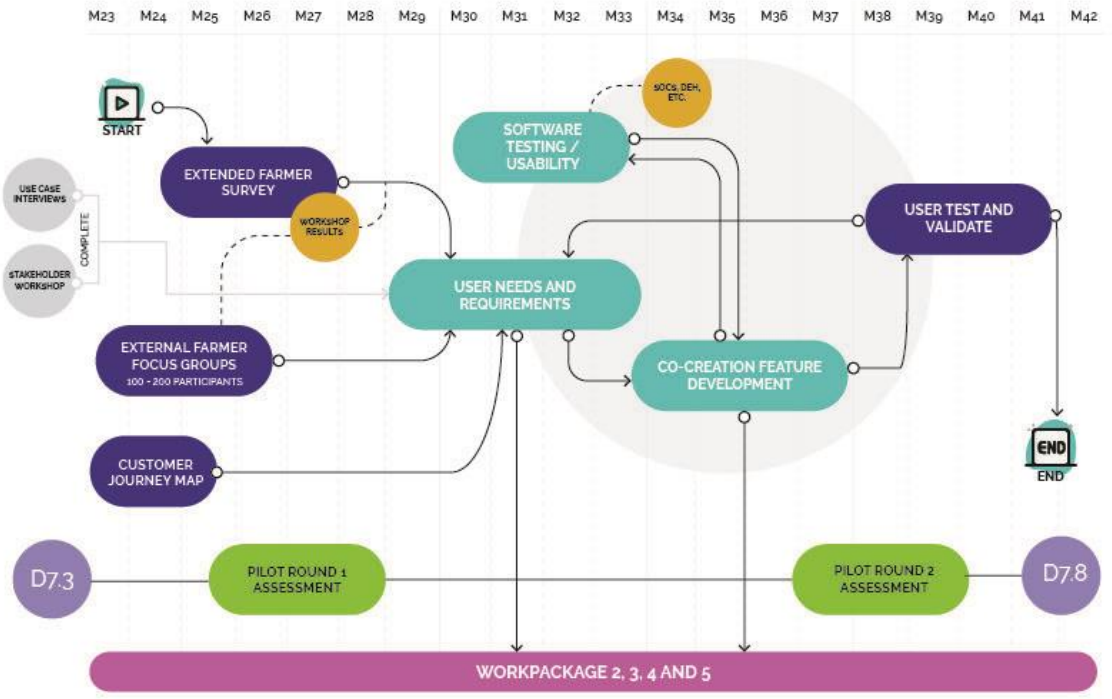

Figure 6 MAA Roadmap M23 - M42

6.8.1 User Needs and Requirements Analysis

The future activities outlined in the roadmap will continue to serve the DEMETER-overarching requirements analysis by focussing on the users' needs and concerns. Various methods (focus groups, surveys, interviews) are employed to get into contact with the farmers as the DEMETER end-users and directly address their needs. Also with the help of existing solutions (DEH, SOCS) or their early versions, farmers' feedback can be gathered in the course of user testing. A crucial aspect is the development of the SOCS that takes place with the help of method from design thinking and human-centered design. That will require its own requirement and user analysis, to be facilitated by interviews and workshops as MAA activities. Through all this, user requirements can be derived. An overarching requirements management board in GitLab is employed in order to collect all needs and requirements and for the technical work packages (2, 3, and 4) to address the user requirements with their technical requirements on the basis of which the DEMETER technical environment is built. Moreover, the requirements analysis within the 20 pilots is going to be monitored more closely with regard to their commitment of outreach (table 8).

6.8.2 Focus Groups

In order to address the pilots' outreach to and engagement of farmers, Work Package 7 will create a script that will be translated into local languages and delivered by local speakers to gather further insight into the user needs and requirements, first within pilots and then towards external stakeholders. A focus group will consist of 10 – 12 participants answering 10 questions in an open dialogue format to encourage conversation.

6.8.3 Customer Journey Map

A customer journey map including user journey maps for specific software will be created to visualise each touch point that each stakeholder interacts with in the DEMETER ecosystem. This will help to visualise the system as a whole for each stakeholder group.

6.8.4 Surveys

Further updated surveys are being distributed internally to pilots with the aim of reaching more pilot farmers and other stakeholders for a better understanding of stakeholders in each pilot country and their needs and concerns.

Once this is completed, with the help of the World Farmers Organisation (WFO) and other farming organisations across Europe a new survey will be sent to obtain further knowledge on needs and concerns of stakeholders external to DEMETER.

6.8.5 Usability and User Testing

Once the maturity of the specific software within DEMETER reaches a point where it can be tested by users, WP7 will run usability and user tests to provide feedback to the technical work packages on pain points and improvements needed.

6.8.6 SOCS development

The SOCS serves as the entry point of the DEMETER ecosystem. Thereby, especially the co-creation feature is of primary importance, as it epitomises the DEMETER MAA approach on the technology level. Therefore, as detailed below, WP7 activities will be concerned with the requirements & stakeholder analysis for the SOCS and its co-creation feature. This includes interviews or workshops for different user groups.

The final results of all of the above will be included in Deliverable 7.9.

7 MAA Activities for DEMETER SOCS Development

Measures to support the user centred development of the Digital Spaces

7.1 Click-Through Prototype Creation

A presentation by Engineering (ENG) to WP7, WP6 and Pilot participants was delivered demonstration the alpha release of the SOCS platform. During this presentation Engineering has some questions around the user journeys for each stakeholder of the platform.

Firstly, WP7 conducted a usability review of the initial alpha release by gaining access and walking through the system as designated stakeholders (farmer , administrator and it provider). During this some initial findings were discovered:

- It took too many clicks to get to the main areas
- There were too many options presented to the user on initial entry, which can cause confusion and cognitive load
- The labelling of the areas was also confusing.

Based on the above findings, a co-design workshop was delivered to answer these questions and to better understand the needs being addressed through the SOCS platform.

We created an initial wireframe to layout some suggestions and for further discussion in this workshop as shown below in figure 10.

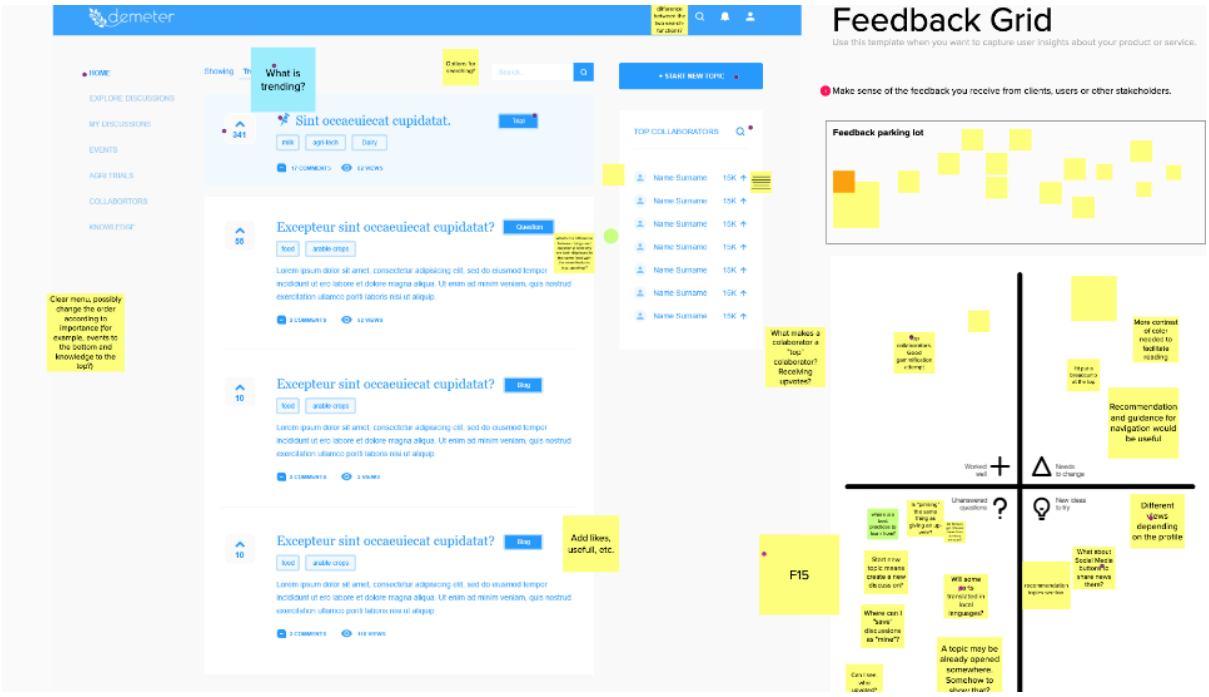

Figure 7 SOCS Co-Design Workshop

The participants of the workshop then used to sticky notes to comment on the layout and language used within the wireframe. This feedback was moved the 'feedback grid' and discussed further.

Based on this workshop a new design was created and delivered to Engineering to start production (Figure 11). The full report from this workshop is discussed in Deliverable 4.4.

In the next phase of DEMTER, further validation of this new design will be undertaken through user testing and validation.

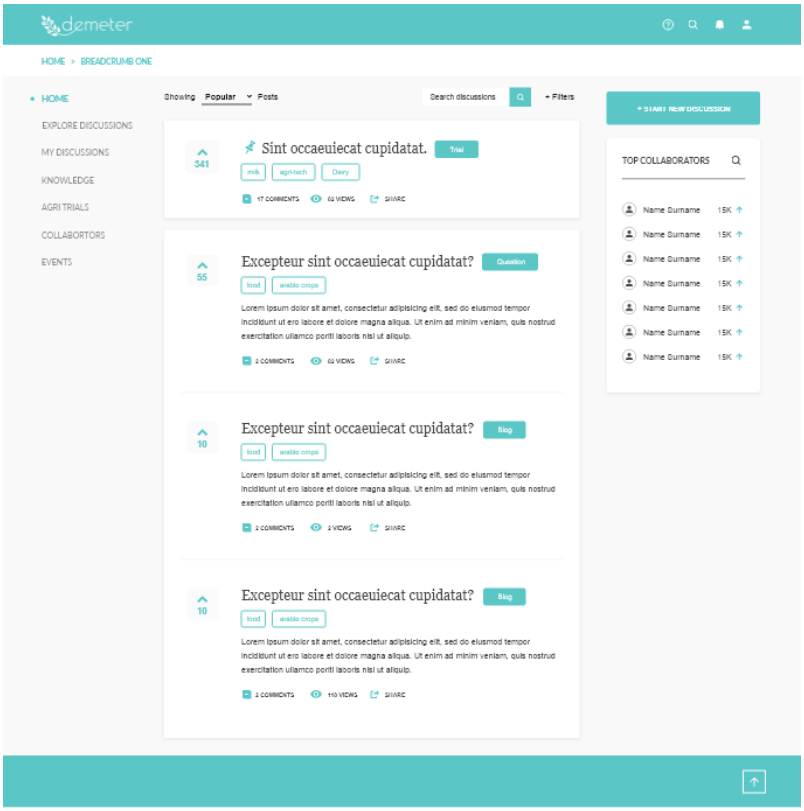

Figure 8 SOCS Version 2 Design

7.2 Data Entities Workshop

As described in Deliverable 4.4, a data entities workshop was developed and delivered where participants discussed the key data points that are needed to describe the key areas in SOCS. The workshop contained 7 exercises to define data from different user perspectives and group them based on commonality. The full details and results of the workshop are included in Annex E of Deliverable 4.4.

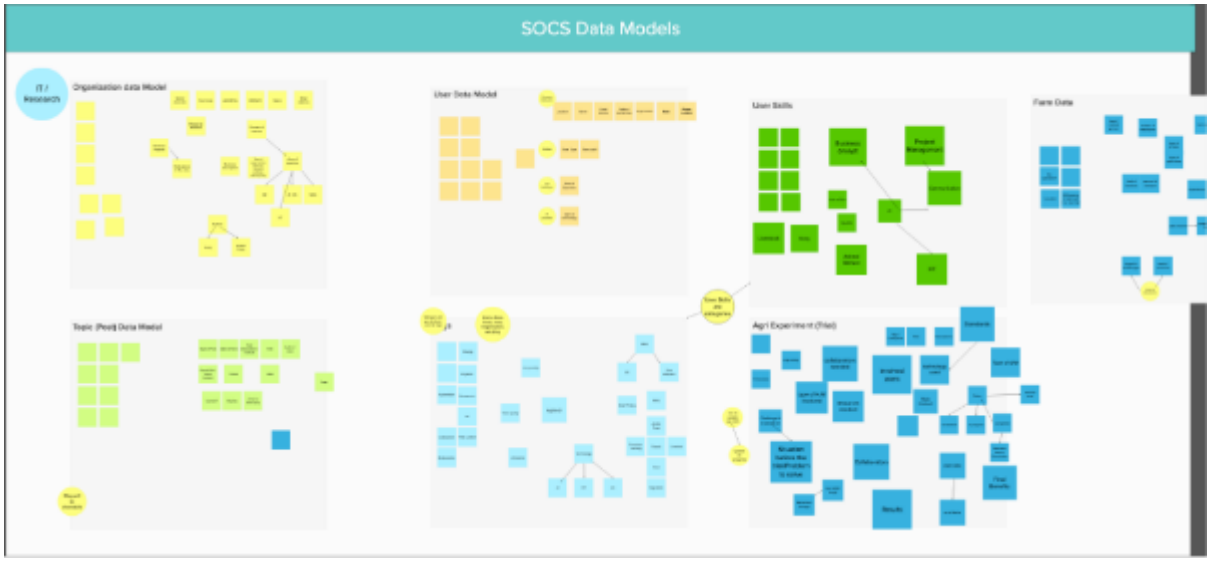

Figure 9 Data Model Workshop on Mural

Key Characteristics for stakeholders and entities were defined and will be included in the next release of the SOCS platform.

7.3 Co-creation Application

The SOCS Co-Creation application comprises the functionality for farmers, technology providers, and advisory services to collaborate on the development of smart-agri solutions. To ensure that this application delivers the highest possible value to all stakeholders, a human-centred design approach (as described in D4.4) will be applied for the development of this application.

The process as well as the roadmap including the most important milestones can be found in D4.4. In the following, we describe the synthesis of the research that has been done over the course of the project runtime. The results of this research helped to define an initial product vision and user groups and were used as input for a prototyping workshop that was conducted between DEMETER project members as well as external UX designers.

7.3.1 Research Synthesis

This chapter describes the different research efforts that were combined and consolidated to inform the development of the co-creation application of the SOCS. The **vision scenario**, as outlined in **Error! Reference source not found.**, comprises the basis for the product vision of the co-creation feature. This makes sure that the goal of the application is directly in line with the goal of the overall project and caters to the needs of DEMETER's target groups. The **stakeholder workshop**, as outlined in **Error! Reference source not found.**, builds the basis for the persona elaboration for the co-creation application. The **needs and concerns** (**Error! Reference source not found.**) that were also developed during the stakeholder workshop, and then further elaborated and prioritised in the **farmer survey** (**Error! Reference source not found.**) as well as the use-case interviews (Section 6.4) are used as the main input for the feature ideation of the co-creation application.

7.3.1.1 Product Vision & Design Challenge

Deriving from the DEMETER vision scenario, the product vision for the co-creation application was formulated as:

> As DEMETER, we want to enable better decision making for all stakeholders of the agri-chain.
>
> To achieve this, the SOCS Co-Creation feature will enable Farmers, Software providers and Agri-Advisory Services to work on smart-agri solutions in a collaborative way, thus ensuring the demand-driven development of affordable, accessible, and interoperable up-to-date technology that fits farmers' needs.
>
> It will enable and promote trust among the parties involved, guarantee data-security and privacy, and ascertains the business viability of the developed solutions through constant involvement of the farmers throughout the entire development process.

From the product vision onwards, the design challenge for the prototyping workshop was defined as:

> How might we design a system that enables farmers and technology providers to co-create innovative, accessible, and up-to-date smart agri-technology?

7.3.1.2 User Personas

For the workshop, two personas were used in order to guide the ideation and prototyping efforts. The first persona, Johannes, was taken from the pool of farmer personas (as described in **Error! Reference source not found.**). The second persona, Maria, resembles the technology providers' perspective and was created for the workshop. Both of the personas are based on the consolidated research efforts that were made since the beginning of the project. It was decided to focus on these two personas as they comprise the two most important target groups for the SOCS. The appearance and the amount of contained information of the personas was amended to the workshop's needs.

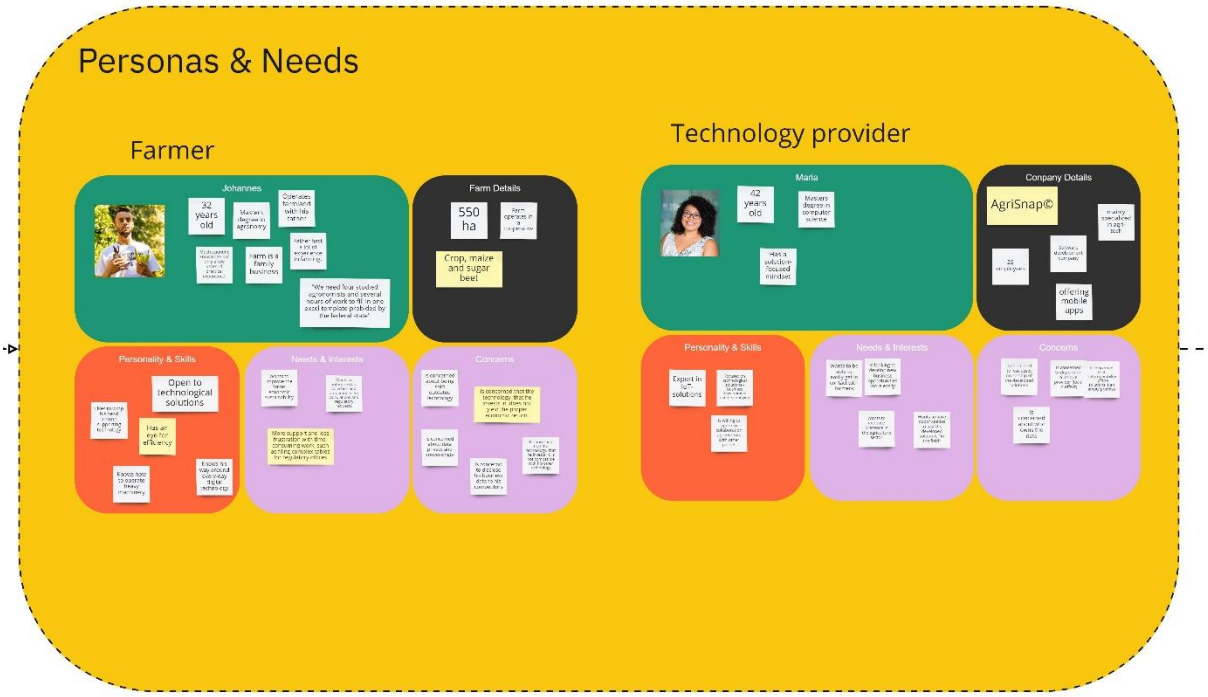

Figure 10 Personas and Needs

7.3.2 Prototyping Workshop

A prototyping workshop was conducted with DEMETER project partners as well as external UX experts from Walton Institute and FIT. The goal of the workshop was to create initial prototypes that resemble the product vision as well as the needs and concerns. Implementation as well as the final style of the interface was defined as out of scope.

Paper prototyping is a common tool in human-centred design that helps considering a variety of concepts and allows a quick visualisation and implementation of various ideas at low cost (near to zero).

The remote workshop was scheduled for two hours, and eight participants took part in it. It was conducted via “Zoom” for video and audio communication and “Miro”, a digital whiteboard that enables participants to co-create creative solutions. It comprised three parts: In the first part, the scenario as well as the personas and the design challenge were presented to create a common understanding among the participants. After all questions were cleared, the session proceeded to the feature brainstorming. After the ideation of the functionalities, the results were clustered and prioritised.

7.3.2.1 Functionality Ideation – “Crazy 8”

The method that was utilised for the functionality ideation was “Crazy 8”. Participants were encouraged to each brainstorm eight ideas in eight minutes. The ideas should comprise functionality features that the co-creation application needs to cover. The method was applied as a silent brainstorming in order to ensure a good quantity of ideas. After the brainstorming, participants presented their ideas to each others and started a clustering. “Clustering” is the thematic analysis of the created ideas, i.e., finding commonalities between them and grouping them together. Participants

then gave captions to the idea clusters that resembled possible features for the application. The most crucial features where then chosen via a “Dot-Voting”, in which participants had three minutes to drag and drop three dots on those idea clusters that they deemed the most important for the application. Figure 11 shows the results of the “Crazy 8” session.

- Subscribe / Notify
- Discovery
- **Voting**
- **Upload a idea linked to the highest voted needs**
- Propose solutions
- Events
- Media
- Discuss solutions
- Development of solutions
- **Collaborative Implementation of a solution**
- Accounting & Profiling
- Manage data

The three most upvoted ideas (highlighted in bold) were then implemented in the paper prototypes. Therefore, participants were divided into breakout rooms, with each group prototyping for one of the three most upvoted feature clusters.

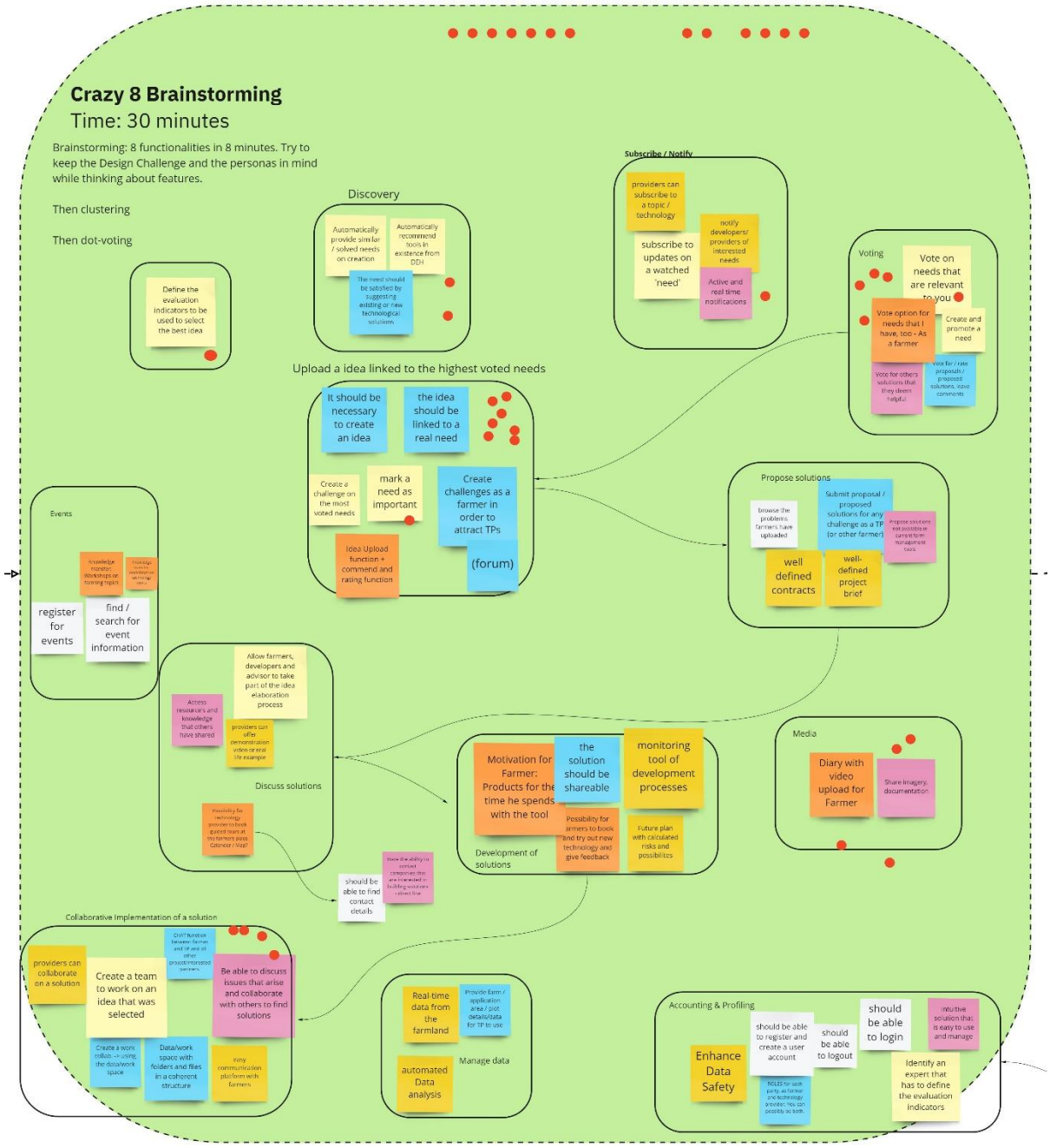

Figure 11: Crazy 8 Brainstorming Co-Creation Application

7.3.2.2 Design Studio

Design Studio is a method that helps creating low-fidelity prototypes in a collaborative way. It is comprised of three phases, with each phase being divided into three activities. In phase 1, participants were asked to come up with their initial design ideas. Hence, the first activity was a round of silent sketching where participants drew their design ideas on a sheet of paper. After uploading their initial design ideas to the Miro board, the second activity started where each participant pitched their design

to the others in their respective groups. In activity three, participants gave each other feedback on the designs in the form of “I liked..” and “I would improve…”.

In phase 2, the same activities were carried out – but the theme for this phase was to improve on the existing ideas using the feedback that was gathered at the end of phase 1. Again, participants sketched, pitched and gave feedback to each other.

In phase 3, the final phase, participants were asked to come up with a joint prototype, using all of the feedback and the ideas from their group peers.

An overview of the Design Studio can be seen in Figure 12 but will be discussed in more detail below.

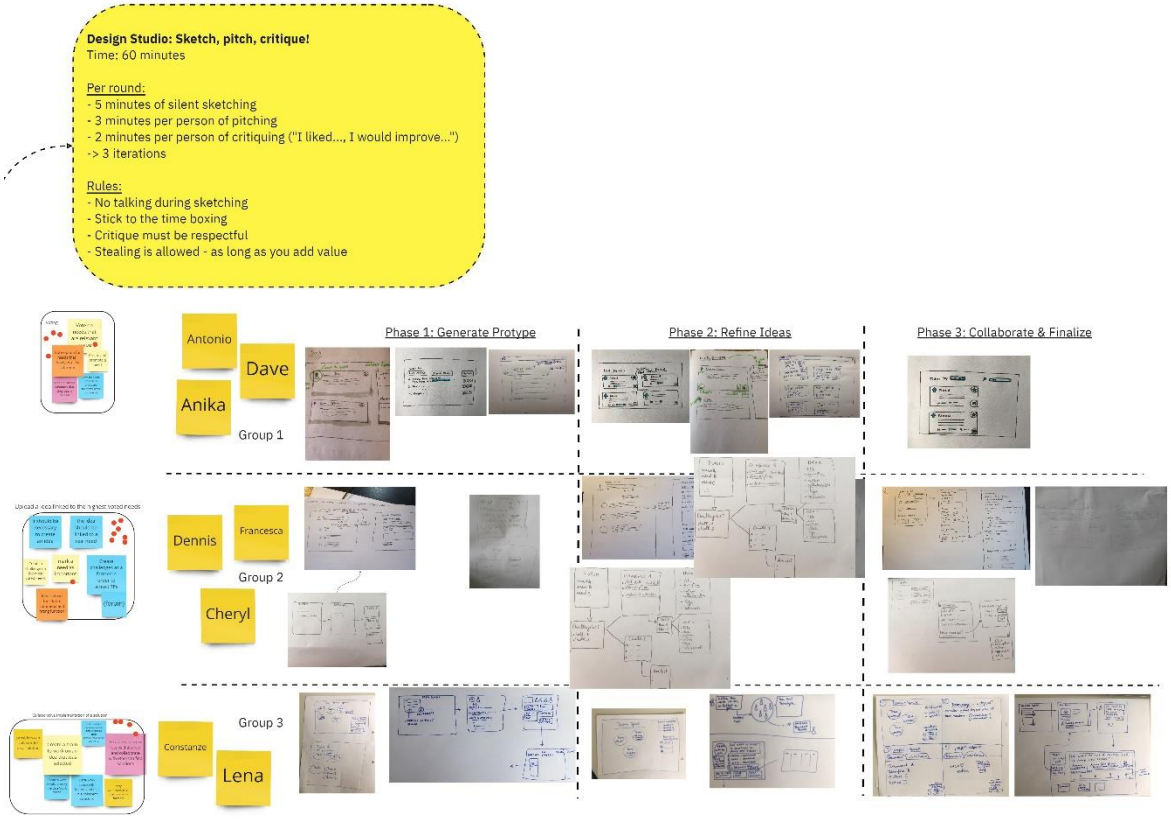

Figure 12: Design Studio Co-Creation Application

Voting: One of the discussed and third-most voted clusters was about how an expressed need gains enough traction so that it can be picked up by developers. The paper prototype shows entities of “needs” that can be upvoted by other farmers (arrow in the upper left-hand corner) organised in tiles. Hashtags on the bottom of the tile enable the categorisation of the respective need. The star in the upper right-hand corner enables users to mark a need as a favourite so that they can easily find needs that are important to them. Also, a filter and a search function were implemented in the prototype.

It became clear in the discussion that a need that gains the support of other farmers and/or developers has to be promoted to a different level of importance. One of the possible solutions to this could be to turn a “need” into a “challenge” that can then be picked up by developers. The discussion around the Voting feature showed that, in the next steps, it has to be decided which attributes a “challenge”

needs to have. Also, user roles need to be defined with different levels of access and rights to take care of the challenges.

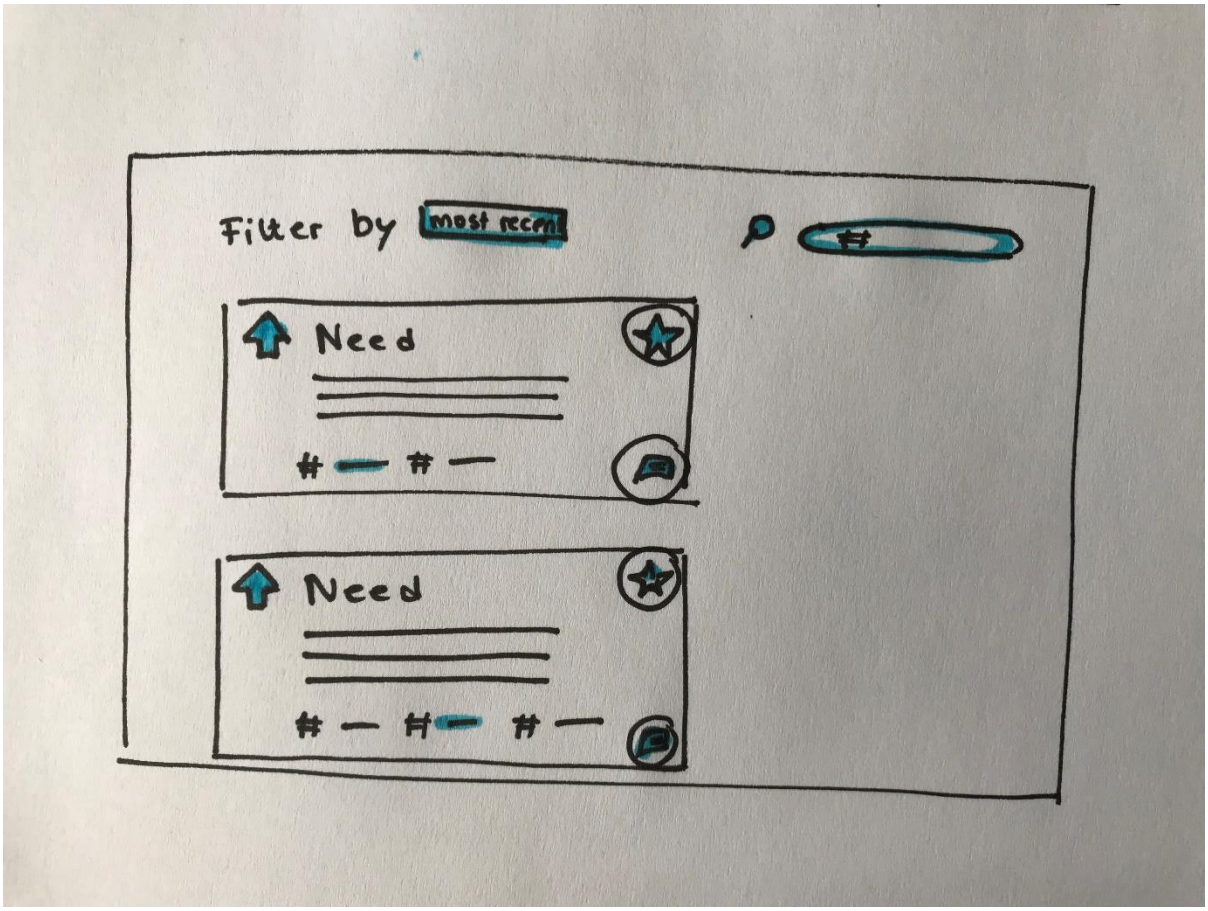

Figure 13 Co-creation Paper Prototype

Upload an idea linked to the highest voted needs: The most upvoted feature cluster was about the functionality of coming up with and uploading ideas that are linked to the highest voted needs. The discussions in this group mainly revolved around the promotion of a need in order to become a challenge and the subsequent proposal of ideas to solve that challenge. Figure 14 shows one of the final prototypes that was created for this feature cluster. The tile on the left-hand side resembles the promotion of a need to a challenge. The tile in the middle shows the template for the creation of a challenge, requiring several attributes. The tile on the right-hand side shows what a challenge could look like when it is created. From here on, ideas can be attached to the challenge, as shown in Figure 15. An additional valuable hint was given during the discussion – that a challenge should be linked to multiple needs.

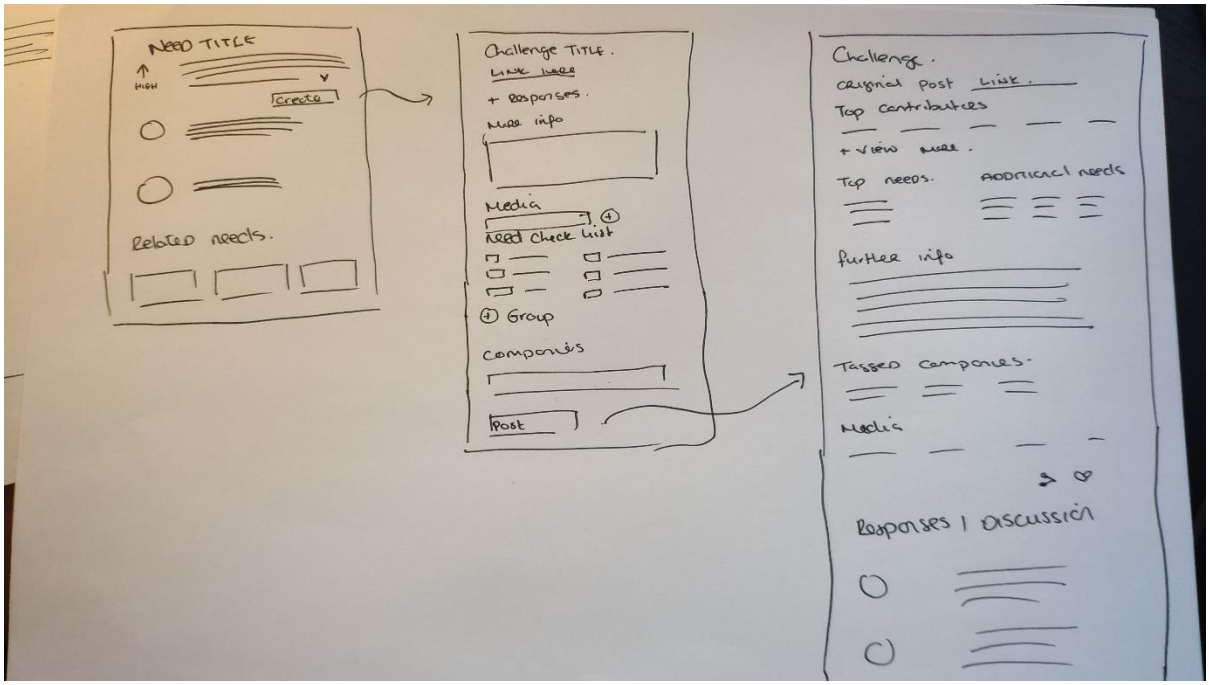

Figure 14: Upload Ideas for Needs I Co-Creation Application

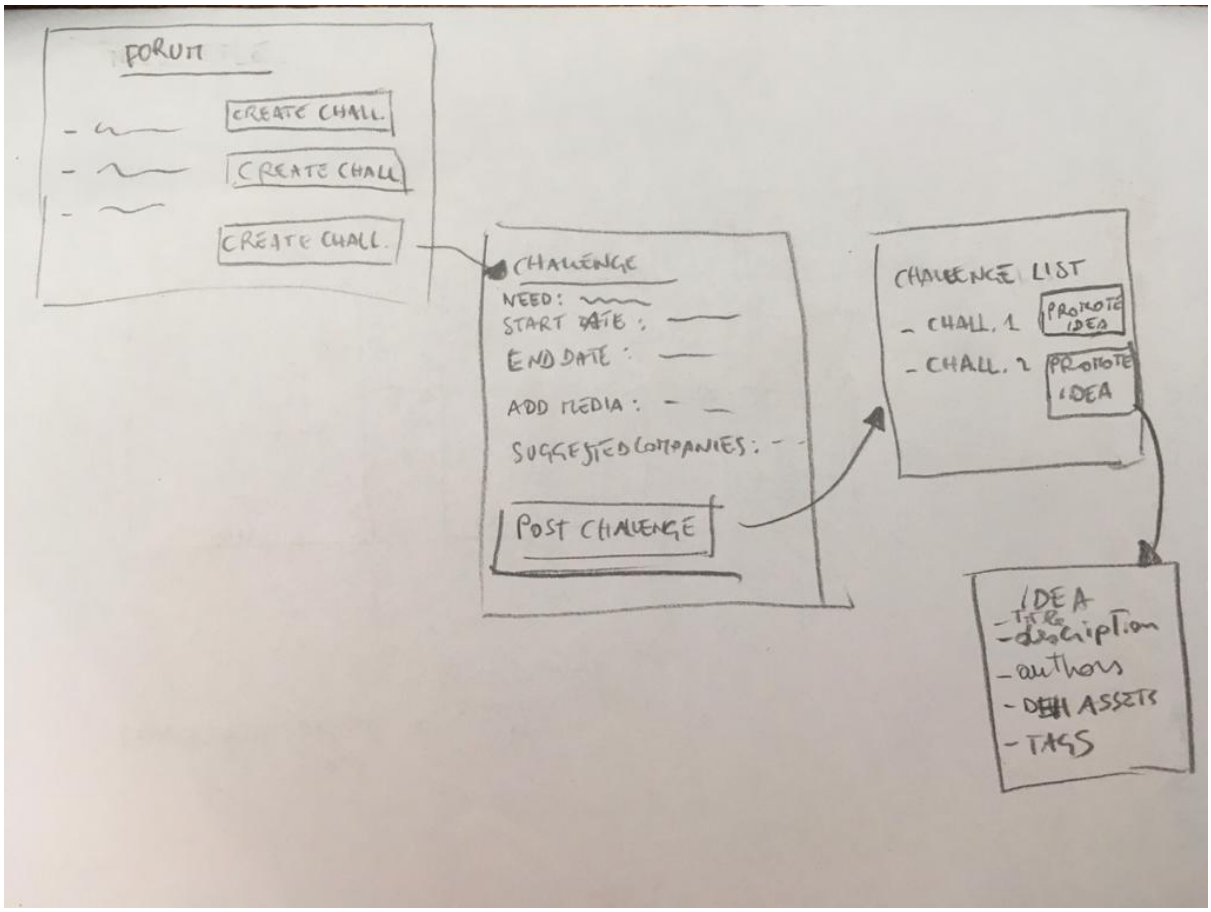

Figure 15: Upload Ideas for Needs II Co-Creation Application

Collaborative implementation of a solution: This cluster was concerned with what happens with a need and an idea after they were being selected and deemed worthy for development. Several features were discussed during the prototyping activities. It was agreed upon that there needs to be space for a) the team, b) the problem/challenge/idea, and c) a project space, where the work-in-progress can be carried out. Figure 16 shows the developed prototype that entails these features. The Problem Board contains information about the challenge at hand. Digging deeper on a challenge, the user can receive information about the problem and can see who the farmers are that promoted the challenge. On the bottom, the prototype contains a timeline as well as additional information about the status of the project. In addition, it was discussed that farmers and technology providers should be able to easily get in touch with each other. Hence, a video call feature was proposed.

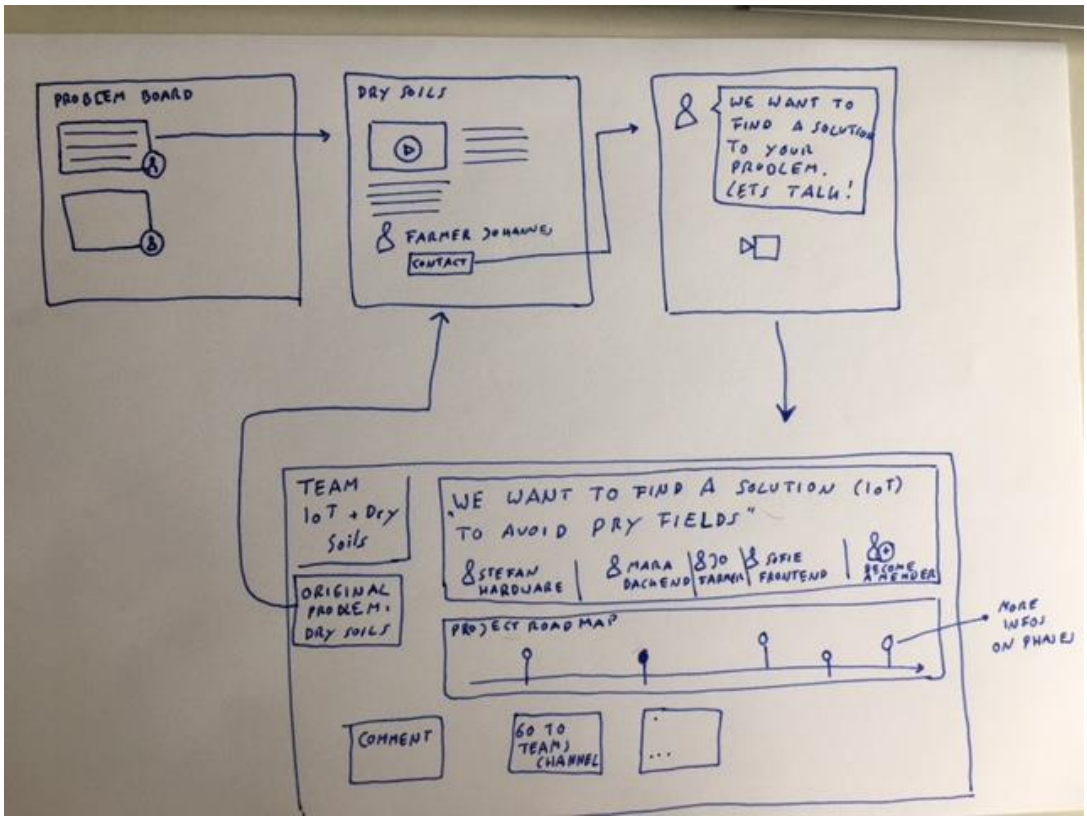

Figure 16: Collaborative implementation Co-Creation Application

7.3.2.3 General results and next steps

Overall, the prototyping workshop yielded good first results for the human-centred development of the alpha version of the co-creation application. Besides the paper prototypes, the workshop was very valuable to foster discussions about possible features and functionalities within the application as well as the procedural logic, i.e., the process that takes an expressed need and turns it into a valuable solution. Several discussions during the workshop pointed at open questions and crucial points that need to be considered and addressed in the future. As for the next steps, the paper prototypes will be used to develop the overall procedural logic of the application, i.e., the site mapping. Then, wireframes will be created based on the paper prototypes. These wireframes will then be tested and refined with potential users of the platform to build the basis for the alpha-version development, as described in D4.4.

8 MAA Activities for DEMETER DEH Development

8.1 Usability Study

As part of the MAA activities in DEMETER, the developed solutions are not only built to meet the stakeholders' needs but also evaluated at different stages of their development in order to assure their usability by providing design recommendations for continuous improvement. In the first half of the DEMETER project, the initial launch version of the DEMETER enabler hub (DEH) was subject to this usability evaluation. Later evaluations will also concern the SOCS platform (to be delivered in D7.9).

8.1.1 Methodology

The quality assessment underlying the usability evaluations in DEMETER is anchored in DIN ISO 9241-11, which specifies the requirements for the usability of interactive products according to the international standard. According to this, the website must climb a three-stage "quality ladder" on its way to becoming a useful and easy-to-use tool – the use of which satisfies the user:

At the lowest level – the "effectiveness level" – the system must provide all the information and functions required by the work task that a user needs to be able to perform his work effectively.

At the second level – the "efficiency level" – it is not only important that all information and functions are available, but that they can be found or operated without unnecessary effort. Therefore, according to ISO 9241-110 (ISO, 2020), the tool must be suitable for the user's task, self-descriptive, controllable (including individualisable), use-error robust, learnable, conform with user expectations, and engaging. Particularly important is the fit of the tool to the typical, "informal task completion" of the users.

At the top level – the "satisfaction level" – the user's physical, cognitive, and emotional responses that result from using the tool should meet the user's needs and expectations. Optimally, users should have a positive attitude towards using the tool resulting from an achievement of all task objectives without negative influences or risks.

Since the DEH is a working tool, the user experience (UX) is significantly influenced by the quality of usability. Accordingly, the UX can to a large extent be construed based on the three levels.

For a rough assessment of the usability of the DEH solution, an evaluation of the product currently in use was carried out as part of a scenario-based walk-through. Typical everyday tasks were run through with the product. The usability evaluation of the working software was carried out by a representative user of the user group "developers", together with a usability expert from Fraunhofer FIT. In this way, the scenario-based walk-through is a cost-effective method to precede prospective, more extensive user testing.

The critical usage incidents identified during the walk-through were anchored according to the relevant usability standard ISO 9241-110 "Interaction Principles". Here, for each usage problem, the usability requirement was identified that was violated and thus represents the cause of the usage problem – in the sense of the usability levels "effectiveness" and "efficiency" of the usability definition presented above. Based on that, design recommendations were derived to inform the optimisation of the DEH.

8.1.2 Results

During the expert walk-through, 67 critical incidents were encountered. Based on that, a total of 65 design recommendation was formulated. This is not a sign of an inadequate development work but a

normal part of any proper software development process. In fact, several aspects of the DEH with potential for improvement were thus discovered. The results were delivered to the developers via a report in tabular form.

Most of the critical incidents concerned violations of the principles, suitability for the user's tasks and conformity with user expectations: On the one hand, to ensure this suitability, additional information that explain the DEH's purpose and functionality should be provided on the interface. Moreover, the search option should be designed in a more flexible way, allowing for full-text search. On the other hand, several technical terms (e.g. "maturity level", "dependencies") should be explained (e.g. by information i's) and the registration process be made more comprehensible in order to address the users' expectations. In terms of self-descriptiveness, navigation and orientation can be improved by providing a clearer structure on the page that is both in terms of the available options (e.g. "return to resources") and of the presented resource information so that the user immediately knows how to access the resource and/or further information. Furthermore, the usability walk-through showed the need for a holistic interface, with regards to both functionality and "look & feel". Thus, the different UI components of the DEMETER platform – i.e. DEH and SOCS – should be linked and oriented towards the same structure in which they are embedded. This could be achieved via an overarching menu that allows for easy transition between the webpages and color-based coding

8.2 Future planned activities

The feedback centred on the design recommendations were fully in line with the DEH developers' current work in progress, to be further implemented in the imminent second, optimised version of the DEH. When the platform is further matured, possibly further user testing will be conducted. Those usability evaluation activities are planned to be extended to include and integrate the SOCS in line with a comprehensive human-centred development according to the MAA.

9 MAA Activities: Pilot specific and national actions

DEMETER, with its 20 pilots, also wants to take a regional/national approach. Responsible for these activities are partners who are active in the respective pilots, who are also familiar with the national environment and who speak the respective national or regional language. These activities can address various aspects of the MAA - from purely informative events, through interactive workshops, to joint developments, for example in the form of hackathons. In addition, explicit efforts are made to cooperate with other initiatives and projects. The following chapters describe the MAA activities that have been developed for individual pilots. Of course, similar events and workshops are planned for the other pilots.

9.1 MAA Activities in Romania

Pilot 1.4, jointly implemented in Romania by the Romanian Maize Growers Association (APPR) and Simavi, aims to develop and implement an IoT Corn Decision Support Platform, designed to facilitate growers' decisions that maximise crop output and quality while applying sustainable agricultural practices. This entails various aspects of maize farming, from smart irrigation to variable rate fertiliser application and integrated pest management practices in order to minimise the environmental footprint.

In the early months, after the project's kick-off, the two partners held several consultation sessions with APPR members to make an inventory of IT solutions and their capabilities used by farmers, as well as the features/improvements needed to address the most widespread challenges of the maize growers.

The main conclusions are that irrigation systems currently operational are closed solutions not sharing software or hardware elements, which limit their possibilities of modification or expansion. The modernisation of irrigation systems has been accompanied by a greater demand for energy. Inefficient fertiliser practices, inappropriate pest and disease control etc., have environmental impacts – and improving these practices will be particularly important in the coming period, with the enlarged environmental and climatic dimension of the CAP.

This consultation process led to the idea of an integrated field monitoring and decision platform in order to identify any problems in due time, be those related to emergence (uniform germination), nitrogen shortages, insect build-ups, disease outbreaks, weed problems and moisture stress effects. The implementation of standardised and interoperable elements will facilitate the exploitation and maintenance of irrigation systems achieving greater efficiencies in water savings.

Another aspect that emerged was that APPR could use the results obtained in DEMETER to make a meaningful contribution to the consultations held by the authorities related to the proposition of eco-schemes, a new instrument in the CAP to support transition towards more sustainable food systems that will be part of the national strategic plans.

For the subsequent phase (starting with the spring of 2020, when the 15 farms in the pilot were endowed with weather stations with various types of sensors) the APPR team started field visits to directly interact with the farm managers both for presenting DEMETER's main goals and gathering first-hand ideas about the challenges faced and the capabilities needed for the solution under development.

In order to have an efficient crop monitoring, we came to the conclusion that we need to integrate various types of data. We developed a questionnaire to gather data on the hybrids used, the soil type

and uniformity, the planting date, the irrigation system (pivot / travelling gun / solid set / drip) – in the case of those farmers using irrigations.

Via sensors, a range of parameters is collected, on (i) atmosphere (temperature / relative humidity: Delta T for pesticide applications, Degree days: Phenological development of plants for tillage and fertiliser applications); evapotranspiration precipitation mm / day; and on (ii) soil (spring soil temperature for planting; soil temperature / atmospheric temperature Growing Degree units); soil moisture.

These types of data are used by the technology partner, SIMAVI.

Meanwhile, APPR presented regularly in its board meetings and at the general assembly of the association the progress of the project, seeking ideas to improve the collaborative approach, trying to identify other aspects to be addressed.

The team also used speaking opportunities to present DEMETER to various audiences (e.g., "SEE THE FUTURE IN AGRICULTURE", conference about smart agriculture, organised by the US Embassy in Bucharest and the Romanian Chamber of Commerce on Oct. 31, 2019, during the INDAGRA Show 2019, the largest agri-food trade in Eastern Europe https://www.indagra.ro/en/. There were be about 300 in the audience, including relevant authorities (the minister of agriculture, representatives of the Min of Research), farmers, media).

Other speaking opportunities were used to increase awareness about the project among various partners and stakeholders, as well as to identify ideas to be embedded in the monitoring platform, as well as synergies to be exploited (workshops organised by research institutes, the annual congress of APPR with international participation, events of input providers who also provide IT solutions to farmers).

The newsletters of the project as well as all other communication materials were translated into Romanian, posted on the website of the Association and disseminated as newsletters to a broad range of stakeholders (farmers, farmer associations, agricultural input industry associations, traders, authorities, media). Special content was developed for the association's communication platform FarmForum: https://farmforum.ro/construirea-unui-sector-agroalimentar-european-digital-inovator-si-durabil/

https://farmforum.ro/agricultura-europeana-pe-coordonatele-pactului-verde-european/

as well as for social media.

APPR and its technology partner SIMAVI filmed and broadcasted (on FB, YouTube, Spotify) a podcast about DEMETER (also posted on project's blog). Another one is planned to bring the firsthand experience of a farmer.

APPR will introduce DEMETER results to the Romanian corn producers and to their counterparts from Europe. The direct collaboration between the IT company SIMAVI and the end-users (APPR) will increase the visibility of DEMETER by providing access to project knowledge to stakeholders, in two directions, both agriculture and ICT related technologies.

9.2 MAA activities in Norway

TFoU and SINTEF have been working with Multi-Stakeholder involvement process around the Norwegian pilot and our related activities in other work packages in DEMETER. The Norwegian Pilot (Pilot 4.1. Dairy Farmers Dashboard for the entire milk and meat production value chain) has two main actors, "Landbrukets Dataflyt", or Agricultural Dataflow, and Mimiro. Both are SMEs with thousands of farmers as indirect owners and with existing dashboard solutions running on different platforms. The idea is to co-develop and explore potential links between them, as well as with the overarching DEMETER architecture and other solutions.

The initial project months (2019) were mainly spent exploring the internal relationship and getting to understand the multiple solutions and overarching framework of the project.

For 2020 we aimed to identify use cases and business-/work processes and initial thoughts from stakeholders on how they envision that the dashboard solutions and other DEMETER solutions can be used. This includes the identification of challenges, requirements and stakeholder mapping. The main activities in 2020 was to inform other Norwegian farm research institutes and some small and medium businesses about Demeter and possibilities for cooperation, interviews and analyses of interviews of 9 Norwegian dairy farmers , analyses of data from survey that 343 Norwegian farmers answered on, several interviews and other communication with a group of 5 farmers with different production (dairy, grain, pork, vegetables, sheep) that also tested a questionnaire that map How is the farmers digital life today, and what requirements, expectations, wishes do they have for digital tools in future? What are the key decision-making parameters for different categories of farmers when it comes to economics, production management and sustainability? How much time do farmers spend on digital services and what could be done more efficiently with improved digital co-operation between actors (public and private)? What registrations of data do farmers make as actors in different systems and programs? What is the communication with other actors, with what extent and frequency, and which media are used for communication about what?

For 2021 we have tested the survey further, and it is now almost finish to be send out to thousands of Norwegian farmers, where we have addresses for every active farm in the country. The survey will go out in August and results analyses afterwards. In addition we have had activity and contact with research institutes and companies in Norway, about establishing a smart agri hub and also more concrete project cooperation. Also this will be worked on in the rest of 2021, as well as meetings and workshops where we shed light of how the HUB in DEMETER, can be developed and used with respect to get improved solutions, production and economy in agriculture and related sectors.

9.3 MAA activities in Belgian/Flandern

VITO plans to organise co-creation workshops in Flanders/Belgium to inform stakeholders on the DEMETER project, and make them more involved in the project, gather their feedback, introduce the DEMETER concepts. Information on DEMETER (and the pilot 3.4) will be given to stakeholders in different formats.

- Info moments for farmers not directly involved in DEMETER now (during Nov-2020 to Mar-2021)
    - Info on scientific results
        - How good is the link between vegetation indices from drone/satellite images and in-field soil samples and yield information
    - Info in VITO-AVR WatchItGrow Decision Support System
        - How to enter data manually
        - How is data transferred automatically from machine to cloud
        - How to view data for one specific field, e.g. map of vegetation parameters
        - How to extract task maps from the DSS: variable rate fertilisation, irrigation, Haulm killing
- Info moments for industry professional – Train the trainer (during Nov-2020 to Mar-2021)
    - Aimed at crop supervisors from potato processing industry
        - How to use the WatchItGrow DSS platform
        - How to explain to farmers how to use the platform
        - How to convince the farmers to start using the platform and share their data
- Workshop for farmers involved in DEMETER Pilot 3.4 (summer 2020)
    - Advice on the use of WatchItGrow DSS (VITO platform) and AVR Cloud platform (AVR), and how they are connected
- Participation in Trade Fairs (2019-2022)
    - Agrotechnica 2019: VITO + AVR demos on WatchItGrow and AVR Connect
    - Belgian trade fairs: Agribex and Interpom (demo from VITO in cooperation with the Belgian Potato Processing Industry; focused on potato processors, potato traders, machinery manufacturers)
- Synergies between DEMETER and other VITO projects
    - VITO has several research projects in Flanders on the use of drone and satellite images linked to croptype phenology. Dissemination of results in these projects will also include info on the WatchItGrow+AVR Connect platform, and the DEMETER approach for agricultural data sharing.
- To Be Discussed: workshops for data-crunching third parties (as of 2021?)
    - Info on the DEMETER Enabler Hub:
        - How to discover data
        - How to use the data processing building blocks
        - How is data ownership handled, data security, …
        - Cost of data use: possible business cases

9.4 MAA activities in Spain

Pilot 5.2 focuses on improving milk quality in dairies as well as animals' well-being and health, and how this can affect the quality and information of processed products, considering also cereals and eggs as raw materials. This pilot also considers end-user involvement in quality testing and feedback provision. We consider in Pilot 5.2 a stakeholder as either an individual, group or organisation who is impacted by the outcome of the pilot. They have an interest in the success of the project, and can be within or outside DEMETER.

Regarding actions for *improving milk quality and animals 'well-being*, different questionnaires will be made to farmers and veterinarians to evaluate and improve applications and application requirements. The questionnaires will have the following questions:

(i) Project Vision:
- *What is your vision for this pilot-product?*
- *What defines success for this pilot-product?*

(ii) Competition:
- *What similar tools are in use today?*
- *Which is the target market?*
- *What are their relative strengths/weaknesses?*

(iii) Users:
- *Who is the primary role for this service/application?*
- *What problems do users have that this product solves?*

(iv) User goals:
- *What defines success and what is a bad result?*
- *What would the users wish for?*

(v) Context of use:
- *What tools do they use today?*
- *What data points do they collect today?*
- *What's missing in the current process that this tool will provide?*

As we are in a very initial phase of the project, it has not yet been chosen in which location the field visits and key informant interviews will take place. However, latest interviews with farmers were done in "Centro de Capacitación Agraria de Palencia" (CIFP VIÑALTA) (http://cifpvinalta.centros.educa.jcyl.es/sitio/). Thus, this is a probable place for future user-involvement related activities.

Regarding *food production and user involvement use case*, Pilot 5.2 intends to integrate data brokering solutions in current production systems of dairy products and pastries, with the purpose of tracking ingredients, and assessing the quality of final products. In order to do this, we have to develop a series of interactions with different stakeholders, both participants in DEMETER (internal) and external. Below we indicate the activities that will be carried out with their purpose and estimated calendar.

Interaction to professionals of food production: through Key Informant Interviews, the pilot participants will hold regular meetings with food production professionals to correctly understand the problems they face in their profession, in relation to the quality information of their products, interaction with suppliers, and relationship with end users.

Activities are planned periodically every 2 months or so, in the form of 2-hour meetings. Some of them, those that require the interaction or direct visualisation of the production processes, will be carried out in the dependencies of the producing company and will be defined as field visits.

Regarding the provision of techniques to involve end-users in the production of food, it is intended to have regular consumer users of pastries and other bakery products (external stakeholders), who appreciate the difficulties of making processed food and value having information on food beyond the one currently labelled. Various activities are planned in which the pilot participants will have technological support in the form of Web applications or mobile phones, which allow them to interact with consumers and ask for opinions and comments on these factors:

- Correct product labelling and additional information about logos
- Personalised information according to user preferences. Assessment of the level of personalisation of the information.
- Evaluation of products according to their consumption and management of recommendations.

These consumer workshops will be organised in Madrid, Spain, where the process of elaboration and processing of products will be explained, as well as instructions of how to use applications to interact to workshop organisers.

9.5 MAA activities in Georgia

The Georgian Farmer Association (GFA) will define, select and invite different interested parties: farmers, agricultural specialists, representatives of NGOs and government working in agriculture, students of Agricultural University, relevant private sector – shops/restaurants/ hotels/distribution companies, different donors etc. GFA will collaborate with INDATA to select Information Technology specialists to participate in planned activities under WP 7. GFA will be involved in organising workshops and trainings. Training curriculum will be developed by DEMETER consortium and GFA will assist in conducting training programme in Georgia. GFA will use various strategies to reach all potential participants for attending the training programmes. GFA will actively use Mobile Application Agronavti in all the relevant activities within the framework of this project. Particularly, all training modules will be adapted and uploaded in Agronavti so that it is available online for further usage. GFA will use its Call Centre and Call Centre operators will be involved during mobilising relevant stakeholders for the workshops and trainings.

The aim of the involvement of different stakeholders in the planned activities and conducting trainings and workshops is to:

- Raise awareness on project activities
- Introduce benefits of project to interested parties
- Increase knowledge on using modern technologies
- Share Agricultural best practices
- Increase access to training materials
- Improve agricultural production methods
- Increase sales due to high quality products produced by using modern technologies
- Increase private sector's and farmers' competitive advantage

Information about project activities will be spread across Georgia in spring using GFA communication channels (website, Mobile application Agronavti, social media, call center).

Theoretical part of planned workshops and trainings will be conducted in Tbilisi and practical component in the selected pilots in Georgia after installation of equipment on sites.

9.6 MAA activities in Italy

The pilot 4.2 focuses on implementing an information flow optimisation across different actors of the milk supply chain – from producers to consumers – ensuring the transparency of all stages. This means that all these actors are "interested parties" in project results that need to be reached by different means and contents. On one side, then, farmers and stakeholders of the agricultural sector, that will be involved in the project to:

- Contribute to the development of modern solutions based on real farmers' needs
- Increase farmers' knowledge about modern technologies
- Improve agricultural advisors and institutions knowledge about the benefit for their job coming from modern technologies
- Foster the adoption of modern technologies
- Improve production and processing methods
- Attract young people to agriculture

On the other side, consumers, final (the single consumer) and intermediate (the retailer), that will be involved in the project to:

- Collect their opinions about their trust towards products coming from "modern production technics"
- Know their level of acceptance of the new label coming from the pilot
- Improve their knowledge about the effort of the agricultural sector to reach their expectation
- Push them towards more aware purchasing habits based on transparency and knowledge of the production process

To these aims, Coldiretti will:

- translate into Italian language the most useful dissemination and communication products from DEMETER (the low level of English is indeed a real obstacle that affects the fulfillment of an effective multiactor approach)
- organise co-creation workshop in Italian territory, during which different stakeholders' opinions will be collected with the use of surveys questionnaires
- contribute to the definition of training materials to be disseminate among other farmers
- produce a set of articles on Coldiretti's online specialised magazine named "Il punto Coldiretti" that is sent via email to 240.000 users (mainly farmers, but also institution, advisors, technical staff of the local branches of Coldiretti) to explain the project objective, results, impacts, and opportunities.

9.7 MAA activities in Ireland

The Irish Farmer Association (IFA) has identified that along with technical performance and pricing, the user experience of a technology solution is becoming a critical factor for the decision-making units on farm. As a result, a core objective for IFA is to develop new approaches for user-centric problem definition and solution building as outlined in section 5.2.1. The aims of these approaches are to shorten the discovery, validation, development and adoption new technologies on Irish farms. As

farmers are the foundation of the modern agri-food supply chain this will also benefit the agricultural industry as a whole through up-stream value building.

IFA sees collaborating with and learning from DEMETER consortium partners and extended industry stakeholders, as being vital to developing a best practice model that encompasses user-centric, participatory design approaches that will help farmers identify and communicate the challenges they face and any opportunities they might see and connecting these with the DEMETER technology solution set.

IFA is working with TSSG, the lead on Task 7.2. Multi-actor Approach Animation, to better understand the best approaches to user-centric and design-driven solution building and see how these approaches are currently being applied in the agricultural sector. We will then investigate how these approaches can be further developed and extended into the primary producer (farmer) to better:

- understand farmer's 'jobs to be done', how the farming sector is segmented, what are the limiting conditions and what are the optimising criteria involved;
- observe and analyse the contexts in which these jobs and tasks take place;
- prototype solutions incrementally.
- and to better implement the new concept in reality.

The use of the DEMETER digital rooms developed as part of Work Packages 3 and 4, in particular the stakeholder open collaboration space (SOCS) will allow for the better facilitation of these collaborative efforts and workshops and open up new knowledge paths that can be currently difficult to organise. However, conducting knowledge transfer and learning activities virtually is a new experience for the vast majority of Irish farmers [2].

IFA will assist in the provision of training and the development of on-boarding strategies to help Irish farmers and other stakeholders' access and use the digital rooms. IFA will be able to offer guidance and insights on the best approaches to training farmers with regards to new technologies. We recently completed a research project on Irish farmers' use of, and attitudes to digital technologies on the farm. We will be able apply some of the key findings and recommendations for the farmer segment of the multi-actor animation, such as:

- stimulating awareness around the positive impacts these new technologies bring (such as saving time and reducing operational costs);
- starting small to include all levels of technology confidence and farm needs and building on what is already being used.
- and that education and implementation of new technologies need to happen closer together.

Details of MAA Activities

IFA participated the 'Remotely Interactive Sprints Seminar' organised and lead by TSSG/Walton Institute on the June 10th, 2020, where we assessed the use of MAA remote tools such as MURAL as a viable means of requirements gathering and collaboration. This also helped IFA in refining the Agri-Sprint model for multi-actor animation for use with IFA members and other agri-industry bodies in IFA's network.

[2] Digital Agriculture Technology: Attitudes and Adoption Study', Irish Farmers' Association 2019: https://ifa.ie/DigitalAg

IFA also attended and participated in Stakeholder Analysis Workshop and Communications Workshop held on the 4th September 2020. We reviewed and analysed the data derived from both workshops to form the basis of a full analysis of stakeholder roles in the DEMETER value chain for section 6 of D 6.2 'Market Analysis and Business Opportunities', and an analysis of the stakeholders needs and concerns and why they need DEMETER, the media habits of stakeholders contained in section 5 of D 6.1 'DEMETER Communication and Dissemination Plan'.

IFA conducted a structured group interview session with IFA members and executives including from our national executive and Future Leaders programme. We used this workshop to determine the data mapping of core Ag Food systems in use in Ireland and illustrate the complexities involved. We discussed the usefulness of the DEMETER AIM model and architecture for enabling practical interoperability between all these critical systems and associated data flows.

This workshop was followed-up with subsequent sessions and lead to drafting of an agricultural data taxonomy including data types and characteristics. A summary of this taxonomy can be found in Table 1. The objective of this mapping is to help with the marketing, exploitation, and onboarding of Irish farmers to DEMETER as either beta testers or post launch of DEMETER to the general public.

	Description	Data Source	Data Stream	Potential Regulations
Farm business operations and management data	Financial Tax Human resource Contracts Supply chain (partnerships, customer and supplier information) Rolling and fixed asset data Machine operations data (fuel consumption, equipment function, reference) Reporting and compliance data (government policies, certification schemes)	On-farm	Localised, Inputted, Automated, Exported	Intellectual property; Personal data protection; Data retention requirements; Consumer protection
Farm production process tracking data (applied processes data)	Livestock data (breed, genetics, feed, production) Animal Health Paddock management Crop seed Dates of operations Water management Disease and pest management (type of herbicides, insecticide, fungicide used and dates and location applied) Yield data Land data (Soil and fertility data, watershed, drainage, tillage practice) GIS, GPS and field boundary data	On-farm	Localised, Inputted, Automated, Exported	Intellectual property; Personal data protection; Consumer protection; National security laws
Data collected to provide general services to agriculture	Climate and weather data (external) Environmental and ecological data Commodity prices and market information	Off-farm	Imported, Ancillary data	Intellectual property; Personal data protection

Figure 17 Summary of Irish Agricultural Data Types and Characteristics

IFA have also conducted two unstructured interviews between January and May of 2021 with farmers we have identified as reference farmers for the roll-out of DEMETER in Ireland. The skills we learned from the Remotely Interactive Sprints Seminar have been most useful for this exercise, particularly in building an empathetic approach in understanding the needs of farmers. The aim of these interviews is to start building farmer end-user profiles to group the functional, social and emotional requirements of our members to inform the further development and refinement of the DEMETER platform. The

concept of DEMETER was explained, and an overview of the pilots were given. We asked both farmers to try and describe the farmer end-user who would most likely adopt and use DEMETER first.

The view is that already highly-functioning farmers who are seeking to optimise all elements of their farm business are more likely to adopt DEMETER as an interoperability solution earlier and participate in beta trials than other motivational or demographic factors.

Draft DEMETER Early Adopter User Profile

- They are aged between 30 and 50 years of age.
- They have money to invest in agricultural technology and in particular for a farm management software package they see as valuable.
- They have not found a farm management software package that is suitable for their needs.
- They have multiple different software and hardware solutions that generate farm data that they need to manage and analyse.
- They are currently using, and are advocates for precision agricultural technology and precision livestock farming technology and practices.
- They are known and visible in the industry.
- They would be considered early adopters of science, technology and research.
- They feel undeserved and underwhelmed by existing farm management systems that are available.
- They are ambitious and eager to scale their enterprises but in a managed and risk-limiting way.
- They are productivity focused and want software that just works i.e. they can easily and quickly input and retrieve farm records and surface the information they need to make decisions without having to access and use multiple different systems.

From this initial draft of the persona (Annex A) we began to build an Empathy Map which is a design thinking principle introduced to IFA by the WP7 leaders. The Empathy Map allows us to build up the intrinsic and the less overt motivations of the farmer.

10 Pilot Report

10.1 Pilot round 1 & 2 assessment

As laid out in D5.5, the pilot assessment in DEMETER as a WP-conjoint activity will be carried out at two points in time: after pilot round 1 (in M25) at the project's halftime and after pilot round 2 (in M27) at the end of the project. Thus, the progress and improvements can be monitored. There will be two main foci that is the performance KPIs as a more objective, number-based assessment (see D5.4) and the end-user acceptance as a more subjective assessment that takes into account those people who actually use the solutions that are developed in the pilots (see below). In this way, the evaluation and assessment within DEMETER follows the human-centred design (HCD) approach according to the ISO 9241-210 standard (ISO 2019).

Standardised questionnaires are suitable to cover the prevalent UX aspects as the basis for a user acceptance and satisfaction assessment (see usability levels in Section 8). Together with the KPIs as defined in D5.5, they represent the means of evaluation for the two pilot rounds. The online questionnaires will be distributed to the end users of the pilots, which will be the responsibility of each individual pilot. The prevalent constructs employed from the UX/WP7 side are described in the following:

The User Experience Questionnaire (UEQ, Schrepp, 2015) is a common tool used to capture both classic usability aspects (pragmatic quality) and more hedonic, experiential aspects. According to Hassenzahl (2003), there are two basic quality dimensions: pragmatic and hedonic quality. Whereas the pragmatic quality refers mostly to usability and the prevention of problems and negative experiences, hedonic quality is non-instrumental and concerns positive emotions and the fulfilment of psychological needs like stimulation and novelty. This distinction is prevalent in UX research and accordingly, the UEQ scales include:

- Attractiveness: Overall impression of the product. Do users like or dislike it?
- Perspicuity: Is it easy to get familiar with the product and to learn how to use it?
- Efficiency: Can users solve their tasks without unnecessary effort? Does it react fast?
- Dependability: Does the user feel in control of the interaction? Is it secure and predictable?
- Stimulation: Is it exciting and motivating to use the product? Is it fun to use?
- Novelty: Is the design of the product creative? Does it catch the interest of users?

Source: https://www.ueq-online.org/

In this way, the UEQ is suitable to be used for the general satisfaction assessment and thus provides a basis for measuring the general user experience and quality perceptions of the components, both from a pragmatic (perspicuity, efficiency, dependability) and an emotional (attractiveness) or hedonic (stimulation, novelty) perspective. In this way, the UEQ takes a variety of user needs into account.

For the development of interactive systems that are suitable not just for the user's task but also for a risk-free, meaningful work and human life, also basic psychological needs and possible user stresses must be considered. In the context of the DEMETER pilots and farmers and their needs for innovation as well as the confidence in their capabilities as farmers, the three basic psychological needs derived from self-determination theory (SDT, Edward L. Deci & Ryan, 1985; Ryan & Deci, 2017) are of special importance and are subject to evaluation: autonomy, competence, and relatedness. Autonomy concerns volitional and self-endorsed behaviour, competence effectively interacting with and

influencing one's environment, and relatedness the closeness to and the care by others (Vansteenkiste & Ryan, 2013).

The application of SDT's three human needs to human-computer interaction (HCI) was originally conceptualised and demonstrated within the Positive Computing approach (Calvo & Peters, 2014; Peters et al., 2018), which puts emphasis on the importance of basic human need support to create a more positive, engaging, meaningful, and psychologically healthy UX. These three needs are of special importance for the digitalisation of agriculture and technological innovations as in this context, users as human beings often work collaboratively and strive to employ self-determined activities in order to deliver their farming produce. Contrasting the active support of autonomy, competence, and relatedness through the DEMETER tools, basic psychological needs can also be actively thwarted by the individual's environment. Transferred to interactive technology, this means that potentially need-thwarting tools in use might cause psychological need frustration in the user, which has been shown to lead to various negative outcomes, such as stress, anxiety, depression, reduced self-control as well as defiant and immoral behaviour (Vansteenkiste & Ryan, 2013). Therefore, it stands to reason to evaluate the DEMETER pilot projects' tools, methods, products, and services for farmers regarding their potential to both support and thwart basic psychological needs in order to design and create technology that is not only suitable for users but suitable for humans.

Thus, on the one hand, farmer's autonomy in using the pilots' solutions must not be thwarted and optimally, be supported to add to a self-determined working environment. Otherwise, users would feel controlled and patronised during use. As interviews with farmers within DEMETER showed, during the increasing digitisation and automation of farming activities, farmers are concerned that technology might decide over their head leaving no room for self-determination. Next, users of those tools should feel competent that is effective and optimally challenged when dealing with the tools to increase their confidence and self-efficacy as farmers and stay engaged in their farming processes. The avertable alternative would be perceptions of chaos, a dearth of accomplishments and feelings of incompetence and frustration. Indeed, farmers are deterred from technology that they expect to leave them at a loss, unable to interact effectively. Third, as interview findings have shown, farmers' needs for relatedness with their co-workers and farming community must be satisfied in line with the collaborative nature of many agricultural activities. Otherwise, farmers would experience neglect, isolation, and disconnection from their local community or workforce. In fact, many farmers rely on local communities or agri-associations to help them with their various responsibilities from managing water resources to complying with legal requirements for farm management. Thus, a questionnaire adapted from the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) to fit the technological environment that DEMETER represents will be applied to examine the pilot solutions' potential supporting or thwarting effects on stakeholders' autonomy, competence, and relatedness.

In line with research in UX and work psychology, these human needs are linked to stress responses when frustrated and positive psychological development and work outcomes like engagement when satisfied. Building upon the UX and human need assessment, another section of the questionnaire will cover the pilots' perceived impact on their own work in the form of value creation, performance, and well-being along with their technology acceptance. The aim is to understand the impact of the DEMETER pilot projects as forerunners of a digitised, interoperable European agri-food sector, on farmer behaviour and attitudes in line with the MMA. Moreover, these work outcomes can be examined for their connection with the perceptions of the solutions' UX and potential need support/thwarting. On a more general note, the results of the user acceptance evaluation can be put in the context of the other pilot round assessment activities.

10.2 Report Overview

A valuable input from pilots in terms of MAA activities is collected in D5.5, where it is possible to find an elaboration of the progress reports filled in by pilots and aimed to collect specific objectives, achievements and results, installation status, technical challenges, end-user training, collaboration among pilots, dissemination activities, challenges, and lessons learnt. The exercise for the pilots was focused on the reporting period which cover Pilot-Round 1 (M12-M20).

Beside the technical sections of these progress reports, in this deliverable we would like to focus more on those one that show interaction with end users, such as “End-user training” and “Lessons learnt”.

The “End-user training” section describes pilot training activities being done to stakeholders for a proper use of equipment and software and to get high-quality feedback. Of the 20 pilots that have completed their progress report, 15 have carried out some training work for some stakeholders. For most of them (12 out of 15), this training has resulted in feedback that has helped to better understand the difficulty or challenge of adapting current technologies to domain experts, like the quantity and quality of data in the dashboards, and it is driven the changes and updates to be done in the future versions of the pilots’ outcomes. For more details the reference deliverable is D5.5.

The “Lesson learnt” section, also collected in D5.5, is a collection of lessons that pilot members have acquired thanks to the interaction with the other partners and especially with end-users. The lessons learnt were provided by 14 pilots, and it is worth to highlight the ones related to suggestions about sensors to be used for specific monitoring and the ones related to end-users needs, more related to how to improve the interface usability.

10.3 Pilot MAA Activities Report

To gain a better understanding of MAA activities that are being carried out withing pilots, a survey was send to all pilot participants, figure 22 below, gives an overview of the types of activities and how many were carried out based on 35 participants in the survey.

These results are also reflected in the following section (10.4), where we gain a better understanding of the reach of each of these pilots and how we can assist them in improving this.

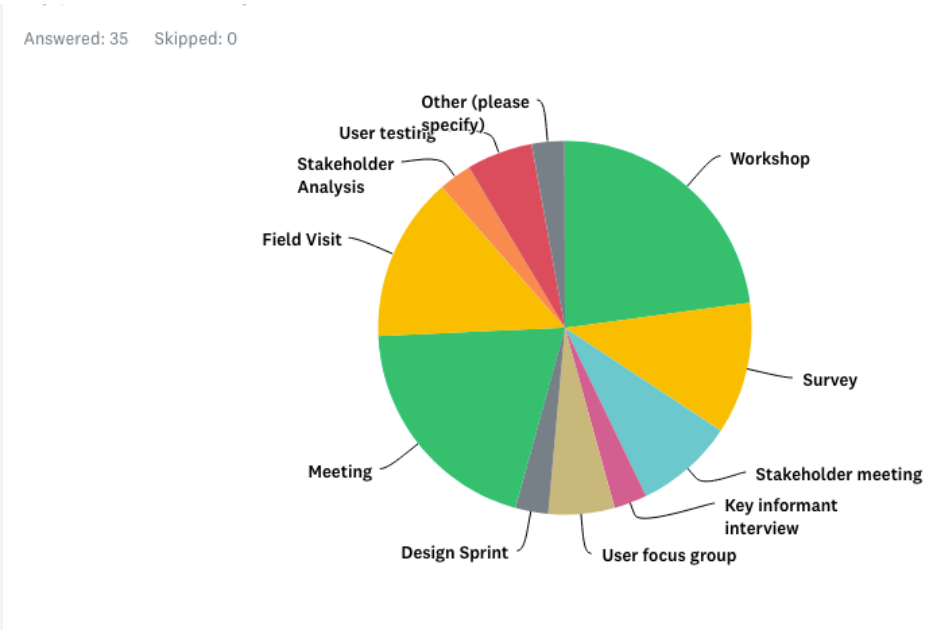

Figure 18 Pilot MAA Survey Results

10.4 Pilot Outreach

In line the with the Pilot MAA activity report, a template was created to capture the exact numbers of farmers that the pilot engage in any way. This pilot outreach was meant to confirm the numbers of farmers the pilots committed to at the beginning of the project. The idea was that after pilot round 1, the pilots provide their current status of the outreach, based on which activities and guidelines can be developed to increase those numbers and the quality of that engagement in pilot round 2. The template , as it is depicted in table 8 below, thus provides the numbers of farmers (or farms) and further columns per pilot for their outreach activities so far and as it is expected over the course of the project. Furthermore, other columns are used to gather information about pilots' methods the user requirement analysis and about their needs for means to increase their outreach, respectively.

The results show that most pilots do conform with their commitment regarding farmer outreach at the beginning of DEMETER. Some even plan to exceed those numbers. Their activities indicate that proper methods to gather user requirements are in place for the most part, like interviews, surveys and feedback collection. This is in line with the Pilot MAA activity report. Interestingly, the pilots indicated a considerable need for multimedia and dissemination material like videos about their projects. Besides, some show the need for more outreach activities like interviews, workshops, or field observations. As mentioned above, appropriate concepts to address those needs and increase the pilots' outreach will be developed. However, some of the higher numbers that were committed to are not being reported back. Further efforts need to ensure that pilots do not only engage those farmers for which they directly employ their solutions, but reach out to a larger number in order to increase the quality of the insights about end-users' needs, concerns, and requirements.

Table 8 Pilot Outreach

Pilot	Deployment Scale	Engaged Farmers	Engagement to date	Activities	Expected Reach	How to increase reach
1.1 & 1.2	7 farmers / ~200 farms involved overall	Solution deployed at 7 farmers: 4 farmers in CCRR de la Margen Izquierda del Porma Feedback collected from 4. Close cooperation with 7 farmer. We have opened the frame to two other Irrigation Communities in the Spanish territory (Mirafles in Jumilla, and Vinalopo in Alicante) to increase the possibilities to impact on more farmers.	7	Interviews about farmers' work. Ongoing exchange and feedback collection Survey about farmers' needs.	10	Do: Continuing the dissemination of the project newsletters. Provide pilot and crop results to prove DEMETER interactions, components and outcomes. Webinars and events showing DEMETER advantages for sharing and exchanging information. Need: Results from DEMETER in order to open the access to other members of the Irrigation Communities. Multimedia material for pilot work and outcomes. Booklets for showing pilot results for dissemination. Social media dissemination for irrigation communities
1.3	50 farmers	Solution deployed at 2 farms (20 farmers) Survey with 13 farmers (user requirements determination)	20	Personal communication. Ongoing exchange and feedback collection. Electronic survey regarding user needs.	50 farmers	We need to showcase measurable results and the benefits from using the DEMETER platform to the final users. Other means in

						the meantime: targeted local workshops, publications
1.4	15 farms	Solution deployed at 15 farms. Data has been collected from all stations implemented on field. Information took from field, related to the vegetation state. Sensor data collected from all 15 farms.	15	Ongoing exchange and feedback collection	15	More interviews, feedback from end-users, need for more observations from the field.
2.1	2 farms	started testing on 2 farms	2	Ongoing exchange and feedback collection	2	Video about pilot project
2.2	12 farms					
2.3	10 farms	10 farms (3x in PL, 2 x in LV, 1 x in NO, 4 x in CZ)	30	Interviews about farmers' work. Ongoing exchange and feedback collection Survey about farmers' needs	30	more interviews, video about our pilot project, presenting the results of the pilot on the events, Booklets for showing pilot results
2.4	10 farms	Solution deployed, tests and pilotage: 10 farmers; recognize the user's need: 504 farmers	514	Interviews about farmers' work. Ongoing exchange and feedback collection Survey about farmers' needs	514	feedback from users, presenting the results of the pilot at the events, video
3.1	30 farms (1500 farmers)	19 farms (15 in Greece and 4 in Italy) and associated advisors	19	Training session to the use of the platform; focus groups with farmers; ongoing exchange with farmers in Italy and with	30 farms directly involved and additional second level farms	video of pilot activity, focus group and feedback from users

				advisors in Greece		
3.2	2000 farmers / 4 intensive IoT farms					
3.3	7 farms	Close cooperation, surveys and testing	5	Interviews about farmers work and surveys, prototypes tests	5	video about pilot daily work
3.4	600 farms	detailed data inputs from 15 farms (AVR connected harvesters)	~100	Platform demo, feedback collection, planning live demo during harvest	100	demo at events, mailing, article in agricultural magazines
4.1	10 farms					
4.2	1 farm	1 farm. Requirements collection. Data collection. Solution deployed.	1 farm	Interview about current activities, data interpretation and DSS needs.	1	participated to the pilot activities
4.3	10 farms	One farm. Sample and data collection on 1 farm and solution to be deployed on 1 farm.	1 farm	Personal communication and feedback collection	1	Inform and disseminate to reach more
4.4	10 farms	Periodically communication and feedback collecting.	5	Cooperation with veterinarians - defining farmers concerns, main issues during the production.	10	Plan: collecting feedback, expanding solution on different type of poultry production, organizing workshops, presentation
5.1	10 vineyards	Solution deployed at 1 large vineyard in Montenegro, 12 vineyards in Serbia (Association with 77 members, all of them can use the service), 2 vineyards and 1 apple orchards in Slovenia, 2 apple orchards and 1 vineyard in Georgia	19	Workshops with farmers.	25	Plan: collecting feedback, organizing workshops, presentations of achieved results
5.2	5 sites	5 sites (1 dairy farm in Finland UC#1, 3 dairy farms	3	Survey about farmers' needs.	3	interviews, booklets, video

		in Spain UC#2), one food processing site UC#3.		Interviews about farmers' work. Demostration activities showing how developed tools can improve thier processes		and demos of pilot activity
5.3	3 farms	Close cooperation: 7 farmers (4 beekeepers, 3 farmers): Apiary monitoring systems implemented in 4 apiaries → close cooperation with AMS provider, frequent feedback, fine-tuning of requirements, data collection, creation of promotional materials (photos of installation of apiary monitoring equipment, films - interviews) 3 farmers are involved in refining the requirements and testing the FMS. 515 respondents (68 beekeepers, 447 farmers) - Surveys conducted to refine requirements, explore needs and concerns of future potential users of the solution.	515	Interviews about farmers' work. Ongoing exchange and feedback collection Survey about farmers' needs	7 farms	Dissemination of information about the project by agricultural advisors, publications in professional journals, video of pilot activity and users success stories
5.4	7 farms	Collecting data during the production process from 3 farms (1 from Montenegro and 2 from Serbia)	3	Interviews with farmers to understand specificity of their production process.	5	Collecting feedback, organizing presentations and workshops

In order to increase the outreach of external farmers, as a basis for further MAA and outreach activities, we also collected the number of farmers that can be reached through the farming organisations that take part in DEMETER.

11 Other Activities

11.1 Remote MAA (Mural Workshop)

As everyone adapted to the changes in our working habits and planned MAA activities due to the current pandemic, it was important that work continued, and all stakeholder's voices would be heard.

To facilitate this WP7 created & facilitated a workshop to introduce tools that would allow all participants to create workshops, hold user focus groups and interviews and facilitate other activities, all while working remotely.

The workshop started with an introduction to the practices that WP7 had begun to implement to facilitate MAA activities, including video and audio software and alternative software for larger activities, like Hackathons and Workshops.

The concept of 'Remotiquette' was introduced during the presentation, this was an important step, as the working environment was changing, so was how we interact with each other. Participants were shown different ways in which meetings and workshops differ and the correct etiquette when attending or facilitating for each as we moved from 'face-to-face' collaboration to 'tile-to-tile', referencing the tiles on a video call that we have now become accustomed to.

Following the presentation, WP7 facilitated an introduction to interactive co-design tools, providing instructions and tips on how to run a successful workshop while being fully remote. During this workshop the participants were encouraged to share tips for working from home, this gave some useful insights but also acted as an introduction to co-design tools. An example the workshop can be seen in the figure below (figure 3)

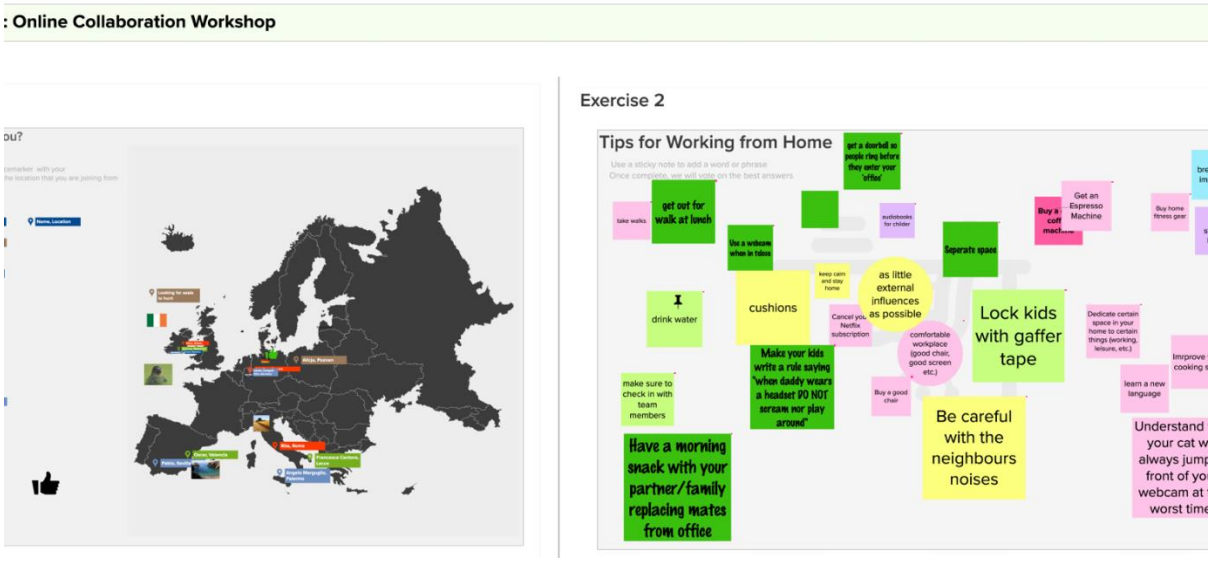

Figure 19 Remotely Interactive Workshop

11.2 Farmer Communications Group

Within WP6, a Farmer Communication Group has been set up to create communication materials to specifically target farmers, ensuring that the content produced is farmer friendly. The group is led by the Irish Farmers' Association with representation from the World Farmers' Organisation, Coldiretti, Georgian Farmers' Association, the Romanian Maize Growers' Association, Walton Institute and Atos. The group is preparing a 'Questions and Answers Guide' to DEMETER that outlines what DEMETER is, how it benefits farmers (segmented by farm size and type) and how farmers can get involved in DEMETER. Following publication of the DEMETER guide, the various farmers' organisations will organise focus groups with their farmer members. This will enable discussion on how DEMETER is perceived, what needs and interests are being addressed, and how DEMETER can be improved to actively engage the farming community. Furthermore, the DEMETER website will contain a 'Farmer' section which will contain all relevant information for farmers such as the guide, farmer interviews, farmer videos etc.

11.3 Open Calls Co-Creation

A co-creation process was used to define the technological needs to feed the DEMETER Open Call #1 called DEVELOP.
The DEMETER Open Call #1 - DEVELOP aimed to enlarge the DEMETER pool of agro-interoperable technologies by engaging tech SMEs towards the integration of their solutions. To identify which technologies should be integrated into the DEMETER platform a co-creation process was undertaken, composed by the following steps:

- Co-creation kick-off presentation at the WPL weekly telco, to share all the steps involved in the management of the open call

- Survey: Request sent to all WP leaders and Clusters leaders to share and fill in a questionnaire, having in mind the farmers' needs and the all the interaction already established with farmers, to identify the agro-interoperable technologies that could empower farmers and enlarge the DEMETER pool of technologies in an innovative manner, with the following fields:
    - Solution Needed - Describe the agro-interoperable type of solutions that could improve and differentiate DEMETER's platform.
    - Justification - Why is that type of solution important to the DEMETER ecosystem (farmers and other stakeholders)?
    - Requirements - Identify, if necessary, the requirements that need to be met by the solution or SME.
    - Deliverables - The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint?
    - Evaluation - Who, within DEMETER, should evaluate the submitted deliverables. SUPPORT ACTIVITIES - Describe the support activities that can be provided to the selected SME(s).

- Following the results of the survey , the results of the 6 topics/challenges received were presented. These included Soil workability, Generic Traceability Component, Crop planting

and renewal, Demeter enablers, DEMETER BPM, ISOBUS enabler. A discussion around the following questions:

- Does the solution benefit a wide range of stakeholders?
- Could it be done internally by DEMETER partners?
- The solution needed fits the available budget (30k)?

A decision was made to update the questionnaire and request additional information from the 6 open call topic proposers. Below is the updated questionnaire field list:

- Specific Challenge - Describe the challenge to be addressed by engaging external SMEs for a 6-month period.
- Topic Justification - Why is that type of solution important to the DEMETER's ecosystem?
- Topic Requirements - Identify, if necessary, the requirements that need to be met by the solution or SME (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc..)
- Deliverables - The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...) EVALUATION - Who, within DEMETER, should evaluate the submitted deliverables? RESOURCES PROVIDED BY DEMETER - Describe the support activities or components that can be provided to the selected SME(s). E.g. Training, technical support, data sets, infrastructure access, in-site visit
- Expected Outcome - Identify the expected result of the SME contribution E.g. Increased precision ,reduction in time Improved efficiency, decreased consumption

The revised versions of the 6 open call topics/challenges were presented and discussed in a meeting devoted to DEMETER Open Call One, involving the WP leaders. Three decisions were made:

- (1) To update once more the questionnaire changing the description of some of the fields to collect better and more understandable descriptions for people outside the DEMETER project. Below is the list of fields that were updated at this stage:
  - Specific Challenge - 1.1 Problem and business need. Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period.
  - Specific Challenge - 1.2 Interoperability challenge. Identify and describe which systems needs to be made interoperable and by which solutions. Max 600 words
  - Topic Justification - Open Call Topic Proposal. Why is that type of solution important to the DEMETER's ecosystem? Map the topic to the DEMETER project objectives. Max. 300 words
  - Topic Requirements - Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform. (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...). Requirement type , Requirement description and Motivation.

- (2) Contact all the pilot leaders to assess their level of interest in each open call topic and identify the likelihood of each one of them to provide relevant data or other kind of support to the SMEs to be selected under each open call topic.
- (3) Proceed with the open call topics aligned with the pilots' interest and capacity to provide relevant support to the SMEs selected through the open call. -3 July 2020 – A presentation of the 6 open call topics were made at the weekly pilot leaders meeting and a questionnaire was shared with them to assess their interest and ability to provide relevant support regarding each open call topic. The pilot leaders were asked to submit their responses by the 10th of July. –

- WP leaders were invited to vote if the Open Call should be launch with or without this open call topic. 17 July 2020 - The voting process resulted in 5 votes against its inclusion and zero votes in favour. It was then decided to launch the open call with the following topics/challenges:
  - Topic 1: Soil workability and humidity monitoring
  - Topic 2: Interoperable Geo Tagged Photo App
  - Topic 3: ISOBUS enable
  - Topic 4: Blockchain-based solutions for agricultural applications
  - Topic 5: DEMETER Business process integration (BPM).

The results of this are available in Annex B (Open Call #1)

12 Conclusion

Using a multi-actor approach aims at including the right people together throughout a project. This includes people from varying backgrounds; farmers, advisors, software and hardware developers and researchers. This provides a multi-directional flow of knowledge that provides a better understanding of challenges faced by users and a clear pictures of the problems that need to be addressed.

This approach changes the narrative from “designing for” to “designing with”, specifically within the design and development process to ensure that all stakeholder needs are met and the final solution is useful and usable.

All the above activities show the extent to which the various stakeholders within DEMETER were engaged in with the projects’ vision of a holistic MAA. Starting with the vision scenario exercise, all project members were aligned on the same vision for DEMETER. Key stakeholder analysis took place to identify and evaluate the main stakeholder groups and how best to reach them.

Targeting these stakeholder, needs and concerns were collected through interviews and surveys, with more of these types of activities planned in the coming months.

The focus of MAA activities then changed to look towards the main components of DEMETER and how these benefited the end users / stakeholders. This work is continuing through further user & usability testing, co-creation workshops and user journey mapping. This will be followed by more stakeholder engagement which will translate into development needs for the technical work packages.

It becomes clear that although the MAA has been facilitated within WP7, the processes through which the outcomes of these activities are being distributed and used by the whole project consortium needs to be improved. Therefore, a roadmap has been outlined pointing towards the different steps that need to be taken to enhance the human-centredness in DEMETER. One central point is the DEMETER-overarching requirements management in GitLab. All activities carried out in WP7 can uncover new stakeholder needs and concerns that may in turn feed into the technical development as user requirements.

The SOCS development at the heart of DEMETER will be a major application area, whereby all stakeholders are brought into the equation, right from the beginning - in order to ensure the prospective establishment of further technological innovations for farmers, of which the DEMETER pilots are the precursors. On the pilot side, workshops and concepts to improve their outreach will be put into place to ensure their user-centric development. In the course of user testing, the appropriateness of the DEMETER solution will be checked and brought to fruition. WP7 will continue to play a major role in supporting the communication between the various stakeholders, from the developers of the technical environment, over the pilot developers and technical providers to the farmers as end-user who look for solutions to address their needs.

D7.3 Annex A

Dissemination level: Public
Submission date: 31/08/2021

Contents

1 Farmer Personas

1.1 Personas from Use Case Interviews

CHRISTOS

Small-scale olive grower, Greece

QUOTE:

„AS A FARMER I WANT TO PROVIDE HEALTHY AND ETHICALLY RESPONSIBLE FOOD BY GROWING OLIVES AS CLEAN AS POSSIBLE, ORGANIC AND FAIR FOR NATURE"

PROFILE – WHO IS HE?

38 years old biologist working in a research institute.

Cultivating farm mainly for self-subsistence.

Inherited land from father and grandfather with about 350 olive trees.

Active farmer for 11 years, grew up in a heavily polluted area leading to an increase in cancer and diabetes in local community.

Personal motivation to operate his land as traditional and close to nature as possible, meaning to use resources wisely and not overirrigate or fertilize olives.

Knows detrimental consequences of pesticide use.

DEFINING TRAITS

- Self-motivated
- Engaged, dedicated.
- Open to innovations that do not interfere with traditional farming methods.

FARM PROFILE

- Small-scale farm characterized by fragmented parcels.
- Parcels with 20 trees but also parcels with 120 trees.
- Mountainous and arid region, hard to plant trees.
- Moderate erosion, stone walls to limit erosion and to create flat area for tree planting.

MOTIVIATION & GOALS & WISHES

Overarching goals:

- Wants to provide healthy, organic, and ethically responsible food.
- Tries to treat plants with as few interventions as possible.
- Wants to keep olive groves, which have been existing there for centuries, for future generations.

Wishlist:

- More and accurate data regarding climatic conditions.
- Improved weather forecasts for specific locations.
- Sensors measuring temperature, soil parameters (moisture, N-Level, P-level) and moisture inside the trees.
- Soil parameters of neighbours could help to get a better overview.
- Decision support and knowledge transfer, for instance, when to put traps, when to cut grass.
- In general, better guidance and corporation for field-specific treatment and management (highly specific information).

CHALLENGES & PAIN POINTS

- Affected by neighbors' pesticide use, water management, and water channeling.
- Huge problems with erosion and soil loss.
- Stone walls, which limit erosion, are being destroyed by community trying to collect snails living in the walls.
- Heavy machinery destroys stone walls.
- Climate change and water stress makes farming challenging.
- Biggest pest problems are insects. Populations might pass from one field to the other - annual appearance. Uses flytraps and organically certified pest management tools.
- Farm is located far away from living place (takes time to get there and back).
- Needs expert knowledge for very specific challenges - general farming advice is often not applicable because each field has its own characteristics.

Farming skill level:

Experienced	○○○●○○	Rookie
Professional	○○○○●○	Amateur
Coordinator / Manager	○○○○○●	Hands on / On field
Tech enthusiast	○○○●○○	Tech skeptic

Figure 20 Persona 1 – Christos – Small-scale farmer from Greece

JOHANNES

Large-scale crop farmer and biogas producer, Germany

QUOTE:

„WE NEED FOUR STUDIED AGRONOMISTS AND SEVERAL HOURS OF WORK TO FILL IN ONE EXCEL TEMPLATE PROVIDED BY THE FEDERAL STATE."

PROFILE – WHO IS HE?

32 years old agronomist. Studied agronomy at masters level.
Cultivating large areas of land with crops, maize and sugar beet.
Operates farmland with his father in a local cooperative with one other agri- businesses.
Much scientific knowledge but only a few years of experience.

Utilizes heavy machinery and modern technology aiming to operate the farm as economically as possible.

Operates the farm as a family business and can rely on experience of former generation.

Paid membership in a local association to regularly receive highly specialized advice, for instance to fulfill regulatory requirements.

DEFINING TRAITS

- Long established
- Regionally well connected
- Family business

FARM PROFILE

- Large-scale farm operating in a cooperative
- Cultivating crop, maize and sugar beet on more than 550 ha
- Since 2006 operating a biogas plant

MOTIVIATION & GOALS & WISHES

Overarching goals:

- Wants to improve economic sustainability (increase farm output, decrease costs)
- aims to optimize farming processes based on data (e.g., field based working hours, machine utilization)
- Keen to automate/optimize data preparation for calculations and regulatory requests.

Wishlist:

- Better support and much easier/usable regulatory requests (e.g., for estimating fertilizer requirements).
- Percentage-wise preparation of data (for which culture / on which field do we spend how much time)
- Better/area-wide acquisition of soil parameters
- In general, more support and less frustration with time-consuming work, such as filling complex and not self-explanatory Excel tables for regulatory offices.
- Collaboration and knowledge transfer with local farmers (current pests, recommendations for pesticide use, decision support for fertilization, expert advice, experiences, etc.)
- An easy, reliable and comprehensive way to regularly calculate expenses and income.

CHALLENGES & PAIN POINTS

- Accurate estimation of fertilizer requirements
- Time consuming, automatable and partly complex office work
- Area-wide and accurate estimation of soil parameters
- Increasing complexity and time demand for bureaucrazy / fulfilling regulations
- Has to spend several days a month handling things like estimation of fertilizer requirements or calculation of field-based working hours
- Estimation of working hours regarding machinery and location/fruit
- Different regulations in different states
- Needs regularly expert advice, experience exchange

Farming skill level:

Experienced	● ○ ○ ○ ○ ○	Rookie
Professional	○ ● ○ ○ ○ ○	Hobbyist / Amateur
Coordinator / Manager	○ ○ ○ ○ ● ○	Hands on / On field
Tech enthusiast	○ ○ ○ ○ ● ○	Tech skeptic

Figure 21: Persona 2 – Johannes – Medium-scale farmer from Germany

SOFIA

Large-scale wine producer, Montenegro

QUOTE:

„THE FARMLAND WE OPERATE IS VERY LARGE AND COMPLEX. OUR AIM IS TO PROOF THAT SMART AGRICULTURE IS WORTH IT AND HELPS TO INCREASE YIELD QUALITY AND OUTPUT WHILE USING RESOURCES EFFICIENT."

PROFILE – WHO IS SHE?

35 years old farm manager. Managing large areas of land, by leading a team of farm workers, agronomists and harvest workers.

Operates more than 2300 ha of farmland with heavy machinery and modern technology.

Very large and complex area to manage with an extreme variety in field size and crops.

Open for digital innovations that improve resource efficiency, yield quality and yield output.

Operating a research area for smart irrigation and smart pest management research projects.

Is regularly asked for advice from local farmers.

DEFINING TRAITS

- Motivated
- Innovative
- Leader

FARM PROFILE

- Large-scale farm, largest vineyard in Europe in a single complex
- cultivating more than 2300 ha
- Mainly vine-grapes, but also olives, apples and other fruits
- Experience in several smart-agriculture research projects

MOTIVIATION & GOALS & WISHES

Overarching goals:

- Wants to improve economic sustainability (increase farm output, decrease costs, increase quality)
- Aims to improve existing technology (e.g., smart irrigation system, smart pest management)
- Wants to proof tech-skeptics that investing in smart agriculture systems is worthwhile.

Wishlist:

- Improvement of cost optimization models
- Decision-support system that incorporates all data gathered on the farm.
- Easy-to-use visualization, interpretation and prediction system for smart irrigation, pest management, fertilization
- Access to and exchange of well-prepared scientific data
- Knowledge exchange with experts and local farmers on interpretation of data
- Expert advice for highly specific challenges
- Data that is accessible in the office and not in the field for saving time

CHALLENGES & PAIN POINTS

- Access to scientific exchange is very limited.
- People working on the field have a lot of experience but are skeptical regarding technology. -> rely more on experience
- Scientific analysis and real results are needed.
- Problems with data transmission - internet connection is bad.
- Hard-to-predict diseases and irrigation/fertilization requirements because of climate change.
- Connection of academic and industry sectors
- Transparency in the supply chain -> image problems
- Scientific guidance and field-specific solutions
- Very rocky soil in the area

Farming skill level:

Experienced	● ○ ○ ○ ○ ○	Rookie
Professional	● ○ ○ ○ ○ ○	Amateur
Coordinator / Manager	○ ● ○ ○ ○ ○	Hands on / On field
Tech enthusiast	○ ● ○ ○ ○ ○	Tech skeptic

Figure 22: Persona 3 – Sofia – Large-scale farm manager from Montenegro

1.2 Persona from IFA

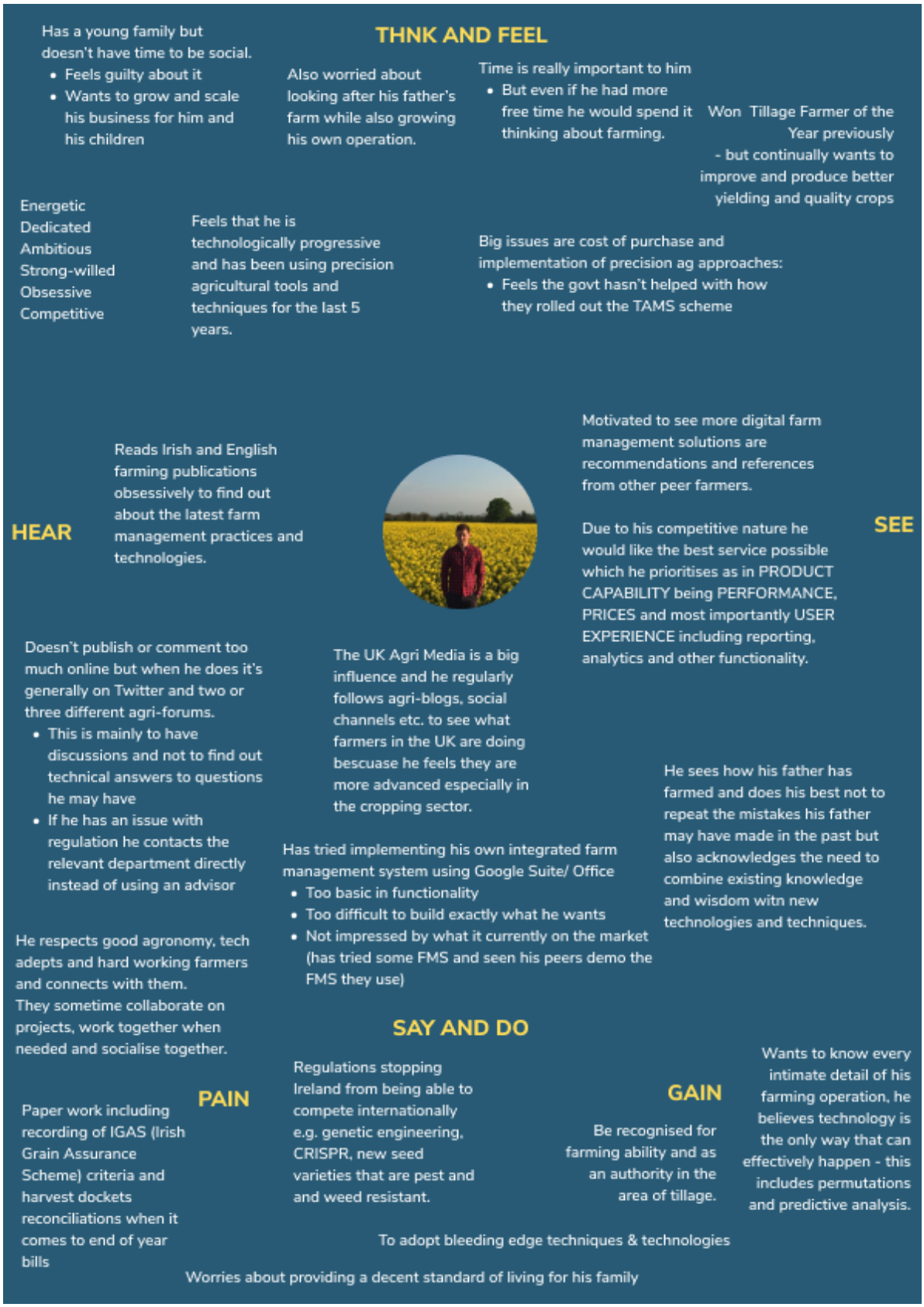

Figure 23 IFA persona creation

D7.3 Annex B

Dissemination level: Public
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Contents

1 Open Call #1 Topics/Challenges

A detailed definition of each one the open call topics, resulting from the co-creation process, is presented below:

1.1 Topic 1: Soil workability and humidity monitoring

SHORT TOPIC NAME
Soil workability and humidity monitoring

1 - SPECIFIC CHALLENGE **1.1 Problem and business need** Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period. Max 600 words
To be able to enter a field to do a work, machine need to find a ground strong enough to support the weight of them. That the reason why the prediction of soil workability is so important. Otherwise, farmers are going to fields and have to come back to farm because the ground is still too wet and therefore increasing the cost and the environmental impact. Soil humidity after rain to predict possibility of work in fields enabling better planting, application and harvest but also reducing cost of machinery
1.2 Interoperability challenge Identify and describe which systems needs to be made interoperable and by which solutions Max 600 words
N.A.

2 - TOPIC JUSTIFICATION Why is that type of solution important to the DEMETER's ecosystem? Map the topic to the DEMETER project objectives. Max 300 words
Several pilots are working on plant protection, fertiliser application or harvest. Potential to reduce cost and save time to farmers.

3 - TOPIC REQUIREMENTS Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform. (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...)		
Requirement type	**Requirement description**	**Motivation**
Technology readiness level		
Source code availability (Open source, etc..))		
Standards (Open standards, etc..)		
Programming language		
Ethics		
Security		
Geographical	EU coverage	
Data management		
Intellectual property rights		
Other(s)		

4 - DELIVERABLES The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...) Max 300 words
1st Sprint (M2) Presentation 2nd Sprint (M4) Feasibility test 3rd Sprint (M6) Proof of concept with one pilot

5 - EVALUATION Who, within DEMETER, should evaluate the submitted deliverables?
Advisory board , WP5 leader, cluster leader

6 - RESOURCES PROVIDED BY DEMETER Describe the support activities or components that can be provided to the selected SME(s). E.g. Training, technical support, data sets, infrastructure access, in-site visit, ...	
Support Activity or Component	Within DEMETER, who provides the support or component?
1) Webinar about DEMETER Architecture	Tech partners

7 - EXPECTED OUTCOME Identify the expected result of the SME contribution E.g. Increased precision of ???, reduction in time of ???, Improved efficiency of ???, decreased consumption of ???, minimisation of ???
Increase the precision of soil humidity leading to: -improving uptime for machinery. -minimising soil compaction. -improving efficiency of pesticide and nutrient application.

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1.2 Topic 2: Interoperable Geo Tagged Photo App

SHORT TOPIC NAME
Interoperable Geo Tagged Photo APP

1 - SPECIFIC CHALLENGE

1.1 Problem and business need

Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period.
Max 600 words

Farmers use to provide information to public administrations for several reasons. Paying Agencies dealing with CAP funds request many information from them in order to pay the subsidies. CAP post 2020 forces paying agencies to monitor the entire territory for agro-environmental and CAP performance checks where Sentinel images are not enough. Then all EU Member States are going to request to the farmers specific Geo tagged photos with specific metadata requested to them in order to conclude the monitoring phase for the whole territory, including small parcels, or crops difficult to being identified by Satellite images. In order to facilitate information provision from farmers to FMIS or to Paying Agencies directly, it is being requested a Geo tagged photos APP using a common open API interface based on REST protocol to demonstrate DEMETER interoperability enables for FMIS.

1.2 Interoperability challenge

Identify and describe which systems needs to be made interoperable and by which solutions
Max 600 words

GeoTagged APP should interoperate with DEMETER Field Book, FMIS interfaces, IACS post 2020 deployed in EU Member States using same **REST Open API defined in DEMETER**

2 - TOPIC JUSTIFICATION

Why is that type of solution important to the DEMETER's ecosystem?
Map the topic to the DEMETER project objectives.
Max 300 words

Every farmer must report to regional, national, European authorities with clear information for many reasons like Common Agricultura Policy (CAP), food security and safety, economical trades. However, there are most of the farmers dealing with plant-crop farming as a type of farm that do not count with Digital Platforms to facilitate data sharing with public, private organisations. There are also farmers who are not active agricultural producers but are maintaining land in good agricultural and environmental conditions. Sometimes they are grouped in cooperatives, sometimes they request the service to a SME, sometimes they go through bank services, or directly to public administrations. Farm Management Information Systems (FMIS) are conceptual models for decision support that should include many of the necessary software components required for data capture, data sharing and decision support. The challenge is to provide an interoperable framework under DEMETER architecture that might allow to provide different components as FMIS enablers like **Geotags APP, Digital Field Book, Machinery Data (IoT) & DSS**
Because it could let Demeter achieve a better expansion and implementation and would allow to diverse pilots from various sectors to interoperate and share common components.
All farmers specially those dealing with plant-crop farming as a type of farm that do not count with Digital Platforms to facilitate data sharing with public administrations. Furthermore, there is one component, **"GeoTag Photos APP"** that will be mandatory in new CAP post 2020.

3 - TOPIC REQUIREMENTS Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform. (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...)		
Requirement type	**Requirement description**	**Motivation**
Technology readiness level	TRL7	There are many Geo tagged photos APPs already available in the market TRL9. Then we only need one with this open API to be deployed in several DEMETER pilots
Source code availability (Open source, etc..))	Open Source	In order to be integrated with other FMIS components
Standards (Open standards, etc..)	API Rest	DEMETER FMIS components are REST.
Programming language	Android, IOS, or multi mobile Platforms (Cordoba, Xamarin)	It must be used from a mobile phone, so it would be better if it is done in a dedicated programming language.
Ethics		
Security	Considering also GDPR and authentication mechanisms	To facilitate data sharing and links with Traceability component
Geographical	Spain, Ireland,	To facilitate farmers associations involvement
Data management		
Intellectual property rights		
Other(s)	Infographics, without specific language menus	It is important that can be used by farmers in all the EU.

4 - DELIVERABLES The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...) Max 300 words
1st Sprint (M2) Presentation Requirements, UML definitions. MAA sessions participation for co-creation and requirements definition 2nd Sprint (M4) Development and test Operational test of Geotagged Photos APP with FMIS prototype provided by DEMETER partners 3rd Sprint (M6) Deployment an integration test

5 - EVALUATION Who, within DEMETER, should evaluate the submitted deliverables?
Pilot cluster leaders involved. Technical Coordinator, Agricultural Coordinator.

6 - SUPPORT ACTIVITIES AND COMPONENTS Describe the support activities that can be provided to the selected SME(s). E.g. Training, technical support, data sets, infrastructure access, in-site visit,...	
Support Activity or Component	Within DEMETER, who provides the support or component?
1 Webinar about DEMETER Architecture and FMIS Framework 2) Webinar about Farmers needs and Data Sharing Legal Requirements	Agricultural Coordinator, Technical Coordinator WP5, WP3
SW Component definition with harmonised API description for Rest	WP3, WP4 (TRAGSA)

7 - EXPECTED OUTCOME Identify the expected result of the SME contribution E.g. Increased precision of ???, reduction in time of ???, Improved efficiency of ???, decreased consumption of ???, minimisation of ???
Geotagged Photos APP addressing API Rest definition provided in the call This will mean for farmers … To facilitate decreasing time for delivery information requested from public administration. To increase the content and quality of data for DSS in FMIS.

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1.3 Topic 3: ISOBUS enable

SHORT TOPIC NAME
ISOBUS enabler

1 - SPECIFIC CHALLENGE

1.1 Problem and business need

Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period.
Max 600 words

Interoperability is one of the key challenges in agriculture, where interconnection between heterogeneous hardware and software systems plays a key role. The farmers are using machinery coming from different vendors, with their internal systems from another vendor (or multiple vendors covering different processes); which makes it hard to collect the data about machinery and integrate it with farmers systems.
The goal is to enable different protocols and standards in the agri-food domain, talk to each other, by enabling machinery to interoperate with other machines and platforms. This would be possible if existing state of the art protocols for machinery (ISOBUS protocol stack) are analysed and appropriate software mapping mechanisms developed to enable collection and communication over ISOBUS protocol stack. The final outcome should be interoperability Gateway software component that implements ISOBUS protocol to cover both technical interoperability defining integration of hardware and software, and semantic interoperability by ensuring that standardised data formats are supported.

1.2 Interoperability challenge

Identify and describe which systems needs to be made interoperable and by which solutions
Max 600 words

Unfortunately the global agricultural industry has struggled to achieve a basic goal: make it easy for the various systems that a grower wants to use in their business “talk to each other” when it comes to a shared data format. eliminate the major pain points to broad use of precision agriculture data by easily enabling interoperability between different software and hardware applications. **The proposed technology will enable interoperability between different agriculture hardware, tools, and systems without any deep knowledge about the ISOBUS protocol.**

2 - TOPIC JUSTIFICATION Why is that type of solution important to the DEMETER's ecosystem? Map the topic to the DEMETER project objectives. Max 300 words
DEMETER is focusing on interoperability as the main digital enabler, extending the coverage of interoperability across data, services, platforms, M2M communication, and online intelligence but also human knowledge, and the implementation of interoperability by connecting farmers, advisors and providers of ICT solutions and machinery. The ISOBUS enabler is important to DEMETER as it enable integration of various machinery to DEMETER framework and it will address the project objective for building knowledge exchange mechanism (O2) by introducing additional set of open standards. As the interoperability between different hardware and software systems is of paramount importance, such interoperability component will ensure seamless communication between hardware/ Machinery and software systems.

3 - TOPIC REQUIREMENTS

Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform.
(E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...)

Requirement type	Requirement description	Motivation
Technology readiness level	TRL6	The developed component should be demonstrated at least in one pilot (TRL6)
Source code availability (Open source, etc..))	Open source	Source code for the software should be made available over the DEMETER github
Standards (Open standards, etc..)	ISOBUS stack: -ISO 11783-3: Data Link Layer with PGN handling -ISO 11783-5: Network Management with any amount of working sets -ISO 11783-6: UT Working Set with AUX-N, Multilanguage and multi-mask support -ISO 11783-7: Application Layer with the data-handling -ISO 11783-10: Task controller client (TC-BAS, TC-GEO and TC-SC)	ISOBUS stack has several layers. The component should cover at lest one or more ISOBUS standards that are necessary for smooth execution of the service

	- ISO 11783-12: Diagnostic Services with Level-1 data - ISO 11783-13: File Server client	
Programming language	.NET, JAVA	
Ethics		
Security		
Geographical	/	
Data management	ISO 11783-10 ISOXML Tag;	
Intellectual property rights	GPL	
Other(s)	Experience in the transport domain, software development (API, edge)	

4 - DELIVERABLES

The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...)
Max 300 words

1st Sprint (M2)
Specification of the requirements and the interoperability architecture for new DEMETER building block.

2nd Sprint (M4)
Implemented and validated API.

3rd Sprint (M6)
Final report.

5 - EVALUATION

Who, within DEMETER, should evaluate the submitted deliverables?

WP2-WP3

6 - RESOURCES PROVIDED BY DEMETER Describe the support activities or components that can be provided to the selected SME(s). E.g. Training, technical support, data sets, infrastructure access, in-site visit, ...	
Support Activity or Component	Within DEMETER, who provides the support or component?
Webinar about DEMETER Architecture Technical support, infrastructure access	WP2-WP3
In-site evaluation in one pilot during 2nd stage	Pilot with machinery available in scope of the planned work
Mentoring	1 partner from WP3

7 - EXPECTED OUTCOME Identify the expected result of the SME contribution E.g. Increased precision of ???, reduction in time of ???, Improved efficiency of ???, decreased consumption of ???, minimisation of ???
Improved interoperability between different equipment and systems. Improved communication efficiency for legacy Machinery.

8 - CONTACT	
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1.4 Topic 4: Blockchain-based solutions for agricultural applications

SHORT TOPIC NAME
Blockchain-based solutions for agricultural applications

1 - SPECIFIC CHALLENGE

1.1 Problem and business need

Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period.
Max 600 words

The need of traceability in agriculture domain is well-know and it could be applied in numerous scenarios from simple supply chain monitoring, procurement tracking, crop and food production, insurance, to land registration and payment of services. The main challenge of the existing blockchain-based implementations is that they still suffer from traditional challenges such as a lack of or poor infrastructure, failures of interoperability, and what is most important the ability to easily integrate in an existing farmer system. Blockchain offers independently verifiable data storage and processing capabilities, perfectly suited to multi-stakeholder environments without centralised control/power over the system.

1.2 Interoperability challenge

Identify and describe which systems needs to be made interoperable and by which solutions
Max 600 words

The interoperability and traceability challenge should be addressed by providing the high TRL Systematic traceability blockchain component, which is already well tested and used in commercial services. The component should implement DEMETER defined semantic model, documented step-by-step integration manual and expose service online which in few steps could lead to integration of the component with any agri-food vertical.

2 - TOPIC JUSTIFICATION

Why is that type of solution important to the DEMETER's ecosystem?
Map the topic to the DEMETER project objectives.
Max 300 words

Demeter ecosystem strives to provide multi-stakeholder environment with transformative impact in the EC food and agriculture sector. The blockchain tends to disrupt traditional value chain offering new opportunities in this sector. Ability of DEMETER to support such innovation will increase impact and showcase the readiness of the project to provide agile infrastructure and adopt new value models beyond the project lifetime. The components correspond to the DEMETER O3 as it introduced the benefits of data ownership and data traceability to farmers:
Empower the farmer, as a prosumer, to gain control in the data-food-chain by identifying and demonstrating a series of new IoT-based, data-driven, business models for profit, collaboration and co-production for farmers and across the value chain, leading to disruptive new value creation models.

3 - TOPIC REQUIREMENTS Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform. (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...)		
Requirement type	**Requirement description**	**Motivation**
Technology readiness level	>6	The technology should showcase already mature technology
Source code availability (Open source, etc..))	Open Source blockchain platform	
Standards (Open standards, etc..)	Standards for document creation and management, electronic signature etc: PaDES/XaDES/eIDAS etc.	Ability to work with documents not only data
Programming language	Open API required, along with Software Development Kits / Libraries for at least 3 of the most popular programming languages: JavaScript, Python, C#, Java, React, Angular, Swift	
Ethics		
Security	Provably Banking-grade	
Geographical	Based in Europe	
Data management	Built-in data storage and querying features, without requirement for translation/middleware layer	
Intellectual property rights	Open source	
Other(s)	REST API interfaces Possibility to deploy private blockchain if needed, with no scalability issues	To be able to integrate it easily in any deployment

4 - DELIVERABLES The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...) Max 300 words
1st Sprint (M2) Requirements definition 2nd Sprint (M4) Integration test 3rd Sprint (M6) Deployment and evaluation in pilots

5 - EVALUATION Who, within DEMETER, should evaluate the submitted deliverables?
Cluster leads

6 - RESOURCES PROVIDED BY DEMETER Describe the support activities or components that can be provided to the selected SME(s). E.g. Training, technical support, data sets, infrastructure access, in-site visit, ...	
Support Activity or Component	Within DEMETER, who provides the support or component?
Webinar about DEMETER Architecture Technical support	WP2 for semantic
Infrastructure access	WP5

7 - EXPECTED OUTCOME Identify the expected result of the SME contribution E.g. Increased precision of ???, reduction in time of ???, Improved efficiency of ???, decreased consumption of ???, minimsation of ???
At least 1 functional prototype of a blockchain-based solution for agricultural applications developed (traceability, commodity trading, machinery/vehicles/equipment management, …)

8 - CONTACT	
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1.5 Topic 5: DEMETER Business process integration (BPM)

SHORT TOPIC NAME
DEMETER Business process integration (BPM)

1 - SPECIFIC CHALLENGE **1.1 Problem and business need** Describe the challenge from a user point of view to be addressed by engaging external SMEs for a 6-month period. Max 600 words
Farm management implies using a range of data sources and creating actions based on the analysis of the collected data. A coherent and streamlined creation of actions and monitoring of their execution is of great importance to medium size and large agriculture companies to ensure efficient utilisation of the work force and the company assets while contributing positively to overall success of the company. The application of a BPM in agriculture helps in separate the logical layer from the technical implementation (i.e., the process modelling and the software application development) which will ensure efficient sharing of data between business processes in real time with business processes integration. This integration allows setting a basis for planning each step of production process, optimal usage of all resources, defining work orders, defining products shipping plan, setting a marketing budget etc. Data are in many cases used as triggers for the next production process thus providing fluently activities workflow.
1.2 Interoperability challenge Identify and describe which systems needs to be made interoperable and by which solutions Max 600 words
The interoperability needs to be ensured in a workflow, that will be defined as a sequence of activities (and transactions) that must be performed; the actors responsible for specific activities; data that have to be sent, received and shared (between actors and/or workflows); and the format to use for the messaging.

2 - TOPIC JUSTIFICATION Why is that type of solution important to the DEMETER's ecosystem? Map the topic to the DEMETER project objectives. Max 300 words
There are many processes in use on a farm, which are still managed using pen and paper or ad-hoc made tools. To improve the overall efficiency, introduction of the best practices from the enterprise industry in relation to business process modelling and execution is required. The main objectives addressed is the empowerment of farmer (O3) by identifying and demonstrating new services facilitating sharing of data between business processes and a series of heterogeneous data for collaboration and co-production for farmers. Through the standardisation of farm workflows, as done in other scientific sectors, progress in the development could be achieved because better data sharing and integration of software applications could be done.

3 - TOPIC REQUIREMENTS Identify, if necessary, the requirements that need to be met by the solution or SME in order to ensure the interoperability of the SME solution into Demeter's platform. (E.g. Technology readiness level needed, use of open source, open standards, use of specific programming language, ethics requirements, security requirements, geographical requirements, data management requirements, intellectual property rights requirements, etc...)		
Requirement type	**Requirement description**	**Motivation**
Technology readiness level	TRL 6 or higher	The proposed component should already be available and used in similar environment (>=TRL5)
Source code availability (Open source, etc..))	Any	
Standards (Open standards, etc..)	REST interfaces, Data integrations standards	Component must have modular interfaces to be easily integrated in any system
Programming language	Java, Python, .NET	Also other widely used languages could be used
Ethics		
Security		
Geographical		
Data management	NGSI-LD	
Intellectual property rights	Any	GPL licence is most welcomed to boost the usage of the component, but other proprietary licenses could be also proposed
Other(s)		

4 - DELIVERABLES The supported SMEs will be engaged with DEMETER for a 6-month period of time, divided by three sprints of two months. At the end of each sprint, there will be an evaluation process based on deliverables. What type of deliverable should be submitted by the SME at the end of each sprint? (E.g. Presentation; feasibility test, operational test, integration test, deployment test, training session, ...) Max 300 words
1st Sprint (M2) Analysis of business processes to be integrated. Business process modelling. 2nd Sprint (M4) Integration plan for a few selected business processes defined. 3rd Sprint (M6) Implementation and validation of a few selected business processes with integration to DEMETER framework.

5 - EVALUATION Who, within DEMETER, should evaluate the submitted deliverables?
WP: 5/6/7

6 - RESOURCES PROVIDED BY DEMETER
Describe the support activities or components that can be provided to the selected SME(s).
E.g. Training, technical support, data sets, infrastructure access, in-site visit, ...

Support Activity or Component	Within DEMETER, who provides the support or component?
Webinar about DEMETER Architecture Pilot site.	Cluster leaders
Technical details for business integration	WP3 partners

7 - EXPECTED OUTCOME
Identify the expected result of the SME contribution E.g. Increased precision of ???, reduction in time of ???, Improved efficiency of ???, decreased consumption of ???, minimisation of ???
Improved workforce utilisation. Improved operation efficiency. Resource usage optimisation.

8 - CONTACT	
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