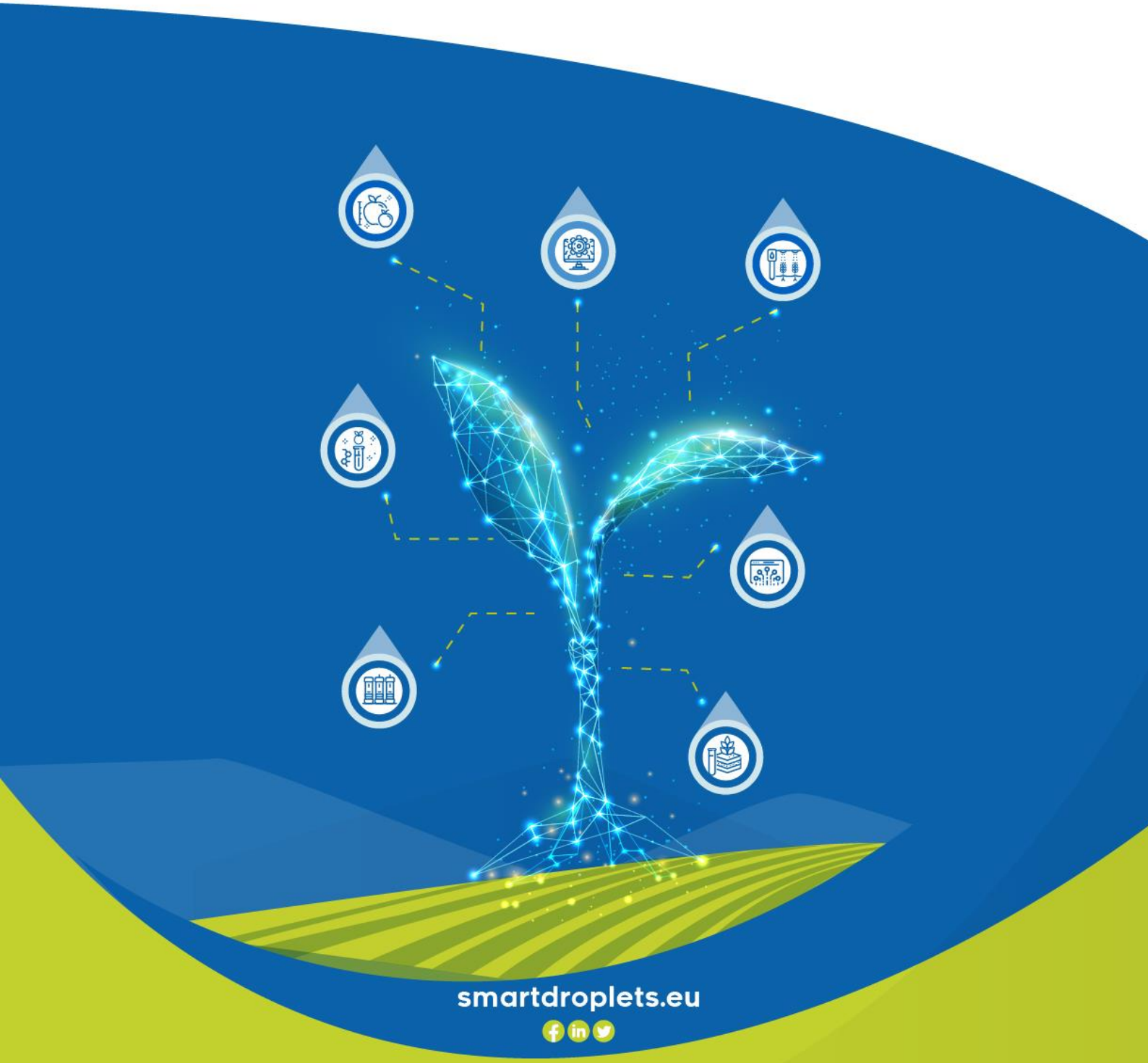
Ref. Ares(2023)4554087 - 30/06/2023

Co-funded by
the European Union

Smart Droplets

D2.3 Smart Droplets Academy – Program, Timeline & Activities



smartdroplets.eu

D2.3 Smart Droplets Academy – Program, Timeline & Activities

Author(s)/Organisation(s)	**Kalliopi Kounani, Loukas Athanasakos /AUA**
Contributor(s)	**Hilmy Baja/WU, Carlos Rizzo/EUT, Thomas Gitsoudis/AFL, Enric Pedros/FEMAC**
Lead Beneficiary	**AUA**
Work Package	**2**
Deliverable type	**Report**
Delivery Date (DoA)	**30/06/23**
Actual Delivery Date	**30/06/23**
Abstract:	**The Smart Droplets Academy, part of the Smart Droplets Horizon Europe (HE) project, offers an exclusive training program to empower non-experts in AI, AI ethics, Data, and Agrifood Robotics. Stakeholders such as farmers, advisors, and agricultural equipment manufacturers are equipped with the necessary knowledge and skills through a multifaceted approach. The Academy includes online webinars, masterclasses, immersive on-site and hybrid demo events, and site visits to showcase real-world applications of Smart Droplets technologies. Training materials, accessible through the Smart Droplets Knowledge Base, provide continuous access to valuable resources. This deliverable provides a comprehensive overview of the program and serves as a living document updated throughout the project's lifespan, reflecting progress and changes.**

Document Revision History			
Date	**Version**	**Author/Contributor/ Reviewer**	**Summary of main changes**
08/06/2023	V1	Kalliopi Kounani	Draft Document
14/06/2023	V2	Kalliopi Kounani	Draft Document
15/06/2023	V3	Kalliopi Kounani	Draft Document
20/06/2023	V4	Kalliopi Kounani	Draft Document
30/06/2023	Final	Kalliopi Kounani/Loukas Athanasakos	Final Document

Dissemination Level		
PU	Public, fully open, e.g. web	**X**
SEN	Sensitive, limited under the conditions of the Grant Agreement	
Classified R-UE/EU-R	EU RESTRICTED under the Commission Decision No2015/444	
Classified C-UE/EU-C	EU CONFIDENTIAL under the Commission Decision No2015/444	
Classified S-UE/EU-S	EU SECRET under the Commission Decision No2015/444	

D2.3 Smart Droplets Academy – Program, Timeline & Activities

SMART DROPLETS CONSORTIUM			
PARTICIPANT NUMBER	PARTICIPANT ORGANISATION NAME	SHORT NAME	COUNTRY
1	GEOPONIKO PANEPISTIMION ATHINON	AUA	GR
2	WAGENINGEN UNIVERSITY	WU	NL
3	FUNDACIO EURECAT	EUT	ES
4	FONDACIJA VIZLORE LABS	VLF	SRB
5	FOODSCALE HUB GREECE ASSOCIATION FOR ENTREPREUNERSHIP AND INNOVATION ASTIKI MI KERDOSKOPIKI ETAIREIA	FSH	GR
6	AGREENCULTURE	AGC	FR
7	AGRIFOOD LITHUANIA DIH	AFL	LT
8	PETKOS ANONYMI ETAIREIA	AGROMA SA	GR
9	CLUSTER DE LA MAQUINARIA I DELS MEDIS DE PRODUCCIO AGRICOLA DE CATALUNYA	FEMAC	ES

LEGAL NOTICE

The information and views set out in this application form are those of the author(s) and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

Co-funded by the European Union

Project name: Spatio-TEmporal Linked data tools for the AgRi-food data space

Project acronym: Smart Droplets
Topic: HORIZON-CL4-2021-DIGITAL-EMERGING-01-09
Type of action: HORIZON Innovation Actions
Project starting date: 1 September 2022
Project duration: 42 months

© Smart Droplets Consortium, 2022.
Reproduction is authorised provided the source is acknowledged.

Table of Contents

Table of Contents 3
1. Executive Summary 5
2. Introduction 5
   2.1. Project Summary 5
   2.2. Purpose, context and scope of this deliverable 6
   2.3. Deliverable Overview and Report Structure 6
3. Methodological Approach and Content 7
4. Reporting of Activities 20
   Introduction to Smart Droplets and Reinforcement Learning 20
   Seminar on Reinforcement Learning and Crop Gym 22
5. Conclusions and Next Steps 24

List of Abbreviations and Acronyms	
AI	Artificial Intelligence
HE	Horizon Europe
GHG	Greenhouse Gas
CAP	Common Agricultural Policy

1. Executive Summary

The Smart Droplets Horizon Europe (HE) project is introducing an exclusive training program, the Smart Droplets Academy, designed to enhance the knowledge and skills of non-experts in the domains of AI, AI ethics, Data, and Agrifood Robotics. The Academy aims to empower stakeholders such as farmers, advisors, and agricultural equipment manufacturers, equipping them with the necessary expertise to navigate these cutting-edge fields.

The Smart Droplets Academy offers a multifaceted training approach, combining in-house training and a custom-built online learning course. The program comprises two core modules: (i) online webinars and masterclasses hosted by domain experts, providing participants with valuable insights and knowledge exchange opportunities; (ii) immersive on-site and hybrid demo events, as well as site visits, allowing participants to experience real-world applications of Smart Droplets technologies focused on the use of the Smart Droplets solution, available during and after the training period.

Training materials, including learning kits, videos, and recorded webinars, will be easily accessible through the Smart Droplets Knowledge Base, ensuring convenient and continuous access to valuable resources. The Smart Droplets Academy operates as an integral part of the broader Smart Droplets HE project, aiming to drive the adoption and integration of advanced technologies in the agricultural sector.

The deliverable titled "Smart Droplets Academy - Program, Timeline & Activities" provides a comprehensive overview of the training program conducted within the Smart Droplets HE project. It serves as a living document that will be regularly updated throughout the project's lifespan (**M10**, M20 and M32), reflecting the progress of project activities and significant changes.

2. Introduction

2.1. Project Summary

The Smart Droplets project is dedicated to advancing the development of Smart Farming Technologies (SFTs), which serve as crucial enablers for farmers to enhance crop monitoring and reduce the usage of chemicals such as fertilizers and plant protection products. Additionally, these technologies contribute to the **reduction of Greenhouse Gas (GHG) emissions**, aligning with the **targets outlined in the EU Green Deal** aimed at **decreasing agrochemicals**. A groundbreaking approach is introduced by the Smart Droplets project, focusing on **improving crop care practices** through the integration of key technological aspects during open field spraying. The project is committed to advancing both **hardware and software capabilities** to facilitate chemical application in a manner that aligns with the sustainability goals of the **EU Green Deal** and the recently reformed **Common Agricultural Policy** (CAP).

The Smart Droplets solution relies on the implementation of **Autonomous Retrofit Tractors** with **Direct Injection System (DIS)** for intelligent spraying, effectively minimizing the exposure of farmers to hazardous chemicals. By leveraging advanced technologies at a high Technology Readiness Level (>TRL 7), the Smart Droplets project adopts a **hybrid approach to spraying operations**. This approach combines **AI/Data/Robotic** technologies that convert data into actionable information with real-time data collected from field demonstrators, which assess and demonstrate optimized technologies in authentic agricultural environments. To ensure the widespread adoption and utilization of digital technologies, the project deploys **innovative tools, services, and recommendations** that are relevant and practical for **farmers, advisors, and policymakers across Europe**. The Smart Droplets project will train/validate and test its solution in two distinct and complementary environments, specifically **apple orchards** and **wheat farms.**

Furthermore, the **Smart Droplets Academy** will be held **annually, engaging and educating non-expert stakeholders** involved in the agricultural vertical on topics such as **AI, AI ethics, Data, and Agrifood Robotics**. The Academy aims to **empower individuals with knowledge and expertise** in these areas, fostering a **collaborative ecosystem**. The Smart Droplets Consortium comprises various actors across the agricultural AI, data, and robotics value chains, ensuring a well-balanced representation of expertise, entity types, and

geographical distribution. This diverse consortium is essential for successfully achieving the objectives of the project.

2.2. Purpose, context and scope of this deliverable

The **"Smart Droplets Academy - Program, Timeline & Activities"** deliverable offers a comprehensive overview of the training program carried out within the Smart Droplets project**.** The importance of empowering individuals without prior expertise is widely acknowledged as a pivotal factor in driving the widespread acceptance and successful integration of advanced technologies in the agricultural sector. Recognizing this imperative, the Smart Droplets Academy has been meticulously designed to cater to a diverse array of stakeholders, encompassing farmers, advisors, and manufacturers of agricultural equipment, all with the overarching ambition of democratizing knowledge and fostering a collaborative ecosystem.

The training program revolves around a rigorous curriculum centered on the following key pillars: (i)**artificial intelligence (AI); (ii) AI ethics, (iii) data management, and (iv) agrifood robotics**. By equipping participants with comprehensive understanding and proficiency in these cutting-edge domains, the program ensures they possess the necessary tools to navigate the intricacies of these fields. Armed with a profound knowledge base and practical skill set, participants are empowered to make well-informed decisions, implement innovative solutions, and actively contribute to the sustainable transformation of the agrifood industry.

The **Smart Droplets Academy** goes beyond theoretical instruction by placing a **strong emphasis on the practical application** of acquired knowledge in **real-world contexts**. This approach bridges the divide between theory and practice, allowing participants to develop a **deep understanding** of the intricate interplay between **advanced technologies and the agrifood sector**. By cultivating this experiential dimension, the program fosters the formation of a vibrant community of non-experts who possess the expertise to effectively harness cutting-edge technologies, thereby contributing substantially to the achievement of the ambitious goals outlined in the Green Deal.

The scientific integrity of the Smart Droplets Academy is upheld through the utilization of evidence-based methodologies and the incorporation of best practices in educational design. The training program provides a **structured and technically robust framework**, ensuring that participants acquire the requisite skills and competencies to surmount challenges associated with AI, AI ethics, data management, and agrifood robotics. Moreover, **the program actively encourages interdisciplinary collaboration**, motivating participants to engage in fruitful **knowledge exchange**, **share their experiences**, and **collectively address the complex sustainability issues confronting the agricultural sector**.

Driven by an unwavering commitment to scientific excellence, technical proficiency, and formalized educational methodologies, the Smart Droplets Academy aims to **stimulate a transformative shift in the agrifood industry**. By nurturing a community of empowered non-experts, the training program lays the groundwork for the successful integration and adoption of advanced technologies, ultimately fostering a more sustainable future in alignment with the ambitious objectives set forth in the Green Deal.

This deliverable outlines the **program's structure**, **timeline, and activities**, while highlighting the **production of learning kits and recorded video content**. It is designed to address the urgent need for knowledge and skills development in emerging technologies, with a specific focus on achieving resource optimization and minimizing chemical waste in chemical applications.

2.3. Deliverable Overview and Report Structure

This section presents an overview of the deliverable titled **"Smart Droplets Academy - Program, Timeline & Activities"** and outlines the report's structure, providing a clear roadmap of its contents. The deliverable serves as a detailed documentation of the Smart Droplets Academy, a purpose-driven training program aimed at empowering non-experts in the domains of AI, AI ethics, data management, and agrifood robotics. It assumes a pivotal role in supporting the overarching objectives of the Smart Droplets project, which centers on optimizing resources and minimizing chemical waste in chemical applications. By fostering knowledge exchange and skill

development, the Smart Droplets Academy contributes to the advancement of sustainable practices within the agricultural sector.

This report adopts a meticulous and logical structure, facilitating an in-depth exploration of the Smart Droplets Academy and its activities. It commences with an introduction that underlines the purpose and significance of the deliverable, emphasizing its role in equipping non-experts in the agricultural industry with the necessary tools and knowledge. This introductory section sets the stage, highlighting the transformative potential of the Smart Droplets Academy in empowering participants to actively contribute to sustainable practices. Subsequently, the report delves into the program overview, offering a comprehensive description of the Smart Droplets Academy training program. This section elucidates the program's structure, duration, and key components, showcasing the diverse range of learning modalities employed to facilitate knowledge transfer.

Continuing, the report focuses on the specific training activities offered within the Smart Droplets Academy. It provides comprehensive descriptions of each activity, encompassing their purpose, format, expected outcomes, and target groups. By delving into the finer details of these activities, the report emphasizes their intrinsic value in enhancing participants' knowledge and skills in the targeted domains. Through hands-on training, interactive sessions, and access to cutting-edge resources, the Smart Droplets Academy empowers individuals to navigate the challenges of the modern agricultural landscape successfully. The report then proceeds to outline the meticulous work plan and timeline governing the training activities. It ensures regular updates and adaptability to accommodate evolving needs and emerging opportunities. By delineating the allocated tasks and necessary resources, the report establishes a clear roadmap for the seamless execution of the training program. A comprehensive timeline, helps track progress effectively, ensuring timely adjustments and alignment with project objectives.

3. Methodological Approach and Content

The methodology employed for the implementation of the Smart Droplets Academy encompasses a well-structured approach that ensures **effective knowledge transfer** and **skills development** among the target audience of **non-expert stakeholders** operating within the agricultural vertical in the domains of **AI, AI ethics, data management, and agrifood robotics**.

The organizations responsible for hosting the Academy, namely **AUA, WU, AFL**, **EUT and FEMAC**, will collaborate closely to deliver a comprehensive training program encompassing both physical and online training content. The methodology encompasses a combination of **training resources**, **learning modalities**, and **continuous improvement cycles** to ensure the highest quality of training content and outcomes (M10, M20 and M32).

To begin with, the Smart Droplets Academy will offer a total of **50 hours of training**, with each hosting organization contributing specific training modules. A breakdown of the training hours includes:

- **15 hours delivered by AUA**,
- **15 hours provided by WU**,
- **7 hours delivered by AFL**,
- **7 hours delivered by EUT,** and
- **6 hours facilitated by FEMAC**.

This collaborative effort ensures a diverse range of expertise and perspectives, enriching the training experience and catering to the varied needs of the participants.

The Smart Droplets Academy employs a range of learning modalities to cater to different learning styles and preferences of the participants. These modalities include:

- ***In-House Training Sessions***: Participants engage in face-to-face training sessions conducted by expert trainers from the participating organizations. These sessions provide a structured learning environment where participants can interact with trainers, ask questions, and engage in practical exercises.

- ***Online Webinars and Masterclasses Hosted by Domain Experts*:** Domain experts host online webinars and masterclasses, offering participants the opportunity to learn from leading professionals in the field. These interactive sessions cover a wide range of topics related to AI, AI ethics, data management, and agrifood robotics, providing participants with valuable insights and real-world examples.

- ***Immersive On-Site and Hybrid Demo Events***: Participants have the chance to attend immersive on-site and hybrid demo events, where they can witness practical demonstrations of AI, data management, and robotic technologies in agricultural settings. These events provide hands-on experiences and allow participants to observe the application of these technologies in real-world scenarios.

- **Site Visits**

The training program will incorporate a blend of in-house training, webinars, and masterclasses conducted by domain experts. These sessions will provide valuable insights into the application of AI, AI ethics, data management, and agrifood robotics in the agricultural context. Participants will have the opportunity to engage with technology demonstrators, gaining hands-on experience and practical knowledge of utilizing these technologies in real-world scenarios.

The Smart Droplets Academy provides a comprehensive set of learning resources to support participants' educational journey. These resources include learning kits, videos, and recorded webinars, which are easily accessible through the **Smart Droplets Knowledge Base,** that will be available in the official Smart Droplets website. Participants can access these resources at any time, allowing for self-paced learning and continuous reinforcement of knowledge gained during the training program. A key aspect of the training methodology is the **availability of training materials** through the Smart Droplets Knowledge Base. Learning kits, videos, and recorded webinars will be accessible to all participants, ensuring continuous access to educational resources even after the training sessions. This repository of information will provide participants with a valuable reference tool to further enhance their knowledge and understanding of AI, data, and robotics in the agricultural domain.

The Academy will equip participants with a comprehensive understanding of best practices and ensure they are well-informed about the potential risks and ethical considerations associated with these technologies. The methodology applied within the Smart Droplets Academy ensures a holistic and comprehensive approach to training. By combining theoretical knowledge, practical demonstrations, and access to training materials, participants will acquire the necessary skills and expertise to effectively leverage AI, data, and robotics in their respective roles within the agricultural sector. The collaborative efforts of the hosting organizations and the integration of expert-led sessions contribute to a well-rounded and impactful training experience, empowering participants to drive positive change and optimize their practices in alignment with the goals of the Smart Droplets project.

The Smart Droplets Academy is committed to continuous improvement and refinement. The deliverable will be regularly updated at each training cycle (M10, M20, M32) to reflect the progress, modifications, and improvements made to the training program. Feedback from participants, trainers, and stakeholders will be collected and analyzed to identify areas for enhancement and ensure the ongoing relevance and effectiveness of the training program.

By following this methodology, the Smart Droplets Academy aims to equip non-experts with the necessary knowledge, skills, and support to harness the potential of AI, AI ethics, data management, and agrifood robotics in the agricultural sector. This methodology ensures a comprehensive and engaging training experience, fostering the adoption of sustainable practices and contributing to the achievement of the Green Deal goals.

In tables below (Table1-4) the detailed descriptions of the Smart Droplets Academy courses are presented.

D2.3 Smart Droplets Academy – Program, Timeline & Activities

Table 1: Smart Droplets Academy Program (Activity Type, Date, Leading Organization, Duration). Activities in bold characters, have already taken place.

Activity Title	Activity Type	Activity Date (dd/mm/yyyy)	Leading Organization	Duration (Hours)
Introduction to Smart Droplets and Reinforcement Learning	**Site Visit**	**16/2/2023**	**WU**	**2**
Seminar on Reinforcement Learning and CropGym	**Masterclasses hosted by domain experts**	**11/5/2023**	**WU**	**2**
Lecture on Reinforcement Learning	Masterclasses hosted by domain experts	June 2023	WU	1
Workshop on Digital Twins	Immersive on-site and hybrid demo events	29/8/2023	WU	2
Introduction to Machine Learning	Online webinars hosted by domain experts	12/09/2023	AUA	2
Machine Learning and Crop Models	Site visits	September 2023	WU	1
Image Classification: From Fully Connected Networks to CNNs. A Weed Detection Approach.	Online webinars hosted by domain experts	10/10/2023	AUA	2
Image Classification: From CNNs to Transformers. A use case for Weed Identification.	Online webinars hosted by domain experts	13/11/2023	AUA	2
Transfer Learning for small datasets in Weed Identification	Online webinars hosted by domain experts	11/12/2023	AUA	2
Graduate Course: Intro to Machine Learning	Masterclasses hosted by domain experts	End 2023	WU	3
Object Detection (Faster R-CNN and YOLO)	Online webinars hosted by domain experts	15/01/2024	AUA	2.5
Annotations Strategies and Techniques/Intro to Object Detection	Online webinars hosted by domain experts	12/02/2024	AUA	2
Improving Performance: Advanced Computer Vision Techniques	Online webinars hosted by domain experts	11/03/2024	AUA	2.5
Seminar on Reinforcement Learning in a changing climate	Immersive on-site and hybrid demo events	Early 2024	WU	2
Workshop on CropGym	Online webinars hosted by domain experts	Spring 2024	WU	2
Introduction to mobile robotics with ROS	Online webinars hosted by domain experts	2024	EUT	2
Precision agriculture vol1: Fundamentals and Technologies	Online webinars hosted by domain experts	2024	FEMAC	2
Precision agriculture vol2: Advanced Crop	Online webinars hosted by domain experts	2024	FEMAC	2

Monitoring and Management				
Simultaneous Localization and Mapping (SLAM)	Online webinars hosted by domain experts	2024	EUT	1.5
Digital Innovations in Arable Farming	Online webinars hosted by domain experts	Second half of 2024	AFL	3
Autonomous Navigation for Ground Robots	Online webinars hosted by domain experts	2024/2025	EUT	1.5
SD solution demonstrators vol1	Immersive on-site and hybrid demo events	First half of 2025	AFL	2
SD solution demonstrators vol2	Immersive on-site and hybrid demo events	First half of 2025	AFL	2
Mobile Robotics in Agriculture: lessons learned	Online webinars hosted by domain experts	2025	EUT	2
Precision agriculture vol3: Integration and Decision Support Systems	Online webinars hosted by domain experts	2025	FEMAC	2

Table 2: Smart Droplets Academy Program (Activity Title, Material, Target Group, Number of Participants). Activities in bold characters, have already taken place.

Activity Title	Material	Target Group	Number of Participants (#)
Introduction to Smart Droplets and Reinforcement Learning	**Recorded Lectures/Learning Kits**	**Industry/ Agricultural Experts**	**3**
Seminar on Reinforcement Learning and CropGym	**Material slideshows**	**Industry/Students/ Researchers**	**20**
Lecture on Reinforcement Learning	Recorded Webinars/ Code Notebooks	Industry/Students/ Researchers	10
Workshop on Digital Twins	Recorded Lectures	Researchers/Agricu ltural Experts	30
Introduction to Machine Learning	Recorded Webinars/ Videos/ Learning kit	Industry/Students/ Researchers	20-30
Machine Learning and Crop Models	Material slideshows	Students/ Researchers	20-30
Image Classification: From Fully Connected Networks to CNNs. A Weed Detection Approach.	Recorded Webinars/ Code Notebooks/ Learning kit	Industry/Students/ Researchers	20-30
Image Classification: From CNNs to Transformers. A use case for Weed Identification.	Recorded Webinars/ Code Notebooks/ Learning kit	Industry/Students/ Researchers	10
Transfer Learning for small datasets in Weed Identification	Recorded Webinars/ Code Notebooks/Learning kit	Industry/Students/ Researchers	10
Graduate Course: Intro to Machine Learning	Recorded Webinars/ Learning kit/ Code Notebooks/ Material slideshows	Researchers/Non-experts	20

Annotations Strategies and Techniques/Intro to Object Detection	Recorded Webinars/ Learning kit/ Material slideshows	Industry/Students/ Researchers	10
Object Detection (Faster R-CNN and YOLO)	Recorded Webinars / Learning kit/ Code Notebooks/ Material slideshows	Industry/ Agricultural Experts	30
Improving Performance: Advanced Computer Vision Techniques	Recorded Webinars	Industry/Students/ Researchers	30
Seminar on Reinforcement Learning in a changing climate	Recorded Lectures/Learning Kits	Industry/Students/ Researchers	20
Workshop on CropGym	Recorded Lectures/Learning Kits	Industry/ Agricultural Experts	10
Introduction to mobile robotics with ROS	Recorded Lectures/Learning Kits	Industry/Students/ Researchers	10
Precision agriculture vol1: Fundamentals and Technologies	Recorded Lectures/Learning Kits	Farmers	10-20
Precision agriculture vol2: Advanced Crop Monitoring and Management	Recorded Lectures/Learning Kits	Farmers	10-20
Simultaneous Localization and Mapping (SLAM)	Recorded Lectures/Learning Kits	Industry/Students/ Researchers	10
Digital Innovations in Arable Farming	Recorded Lectures/Learning Kits	Farmers/Growers/ Agronomists/ Farm Advisors/ Agri-tech developers	20-30
Autonomous Navigation for Ground Robots	Recorded Lectures/Learning Kits	Industry/Students/ Researchers	10
SD solution demonstrators vol1	Recorded Demonstations	Farmers/Growers/ Agronomists/ Farm Advisors/ Agri-tech developers	10-20
SD solution demonstrators vol2	Recorded Demonstations	Farmers/Growers/ Agronomists/ Farm Advisors/ Agri-tech developers	10-20
Mobile Robotics in Agriculture: lessons learned	Recorded Lectures/ Learning Kits	Industry/Students/ Researchers	10
Precision agriculture vol3: Integration and Decision Support Systems	Recorded Lectures/ Learning Kits	Farmers	10-20

Table 3: Smart Droplets Academy program (Activity Title, Activity Description). Activities in bold characters, have already taken place.

Activity Title	Activity Description
Introduction to Smart Droplets and Reinforcement Learning	**An Introduction to Reinforcement Learning (RL) and an in-depth dive into the workings of CropGym. Lengthy discussions between (agriculture and artificial intelligence) domain experts was done to find a middle ground in ways to deploy CropGym in the field.**

Seminar on Reinforcement Learning and CropGym	**A seminar about reinforcement learning and CropGym. A dive into the workings of CropGym and how it could be interesting for agronomers.**
Lecture on Reinforcement Learning	A recorded lecture about policy approximation. Done in a classroom full of PhD and Master's students of WU.
Workshop on Digital Twins	A workshop surrounding Digital Twins (DTs) that will feature experts from around Europe, presenting the state-of-the art advancements regarding DTs for agriculture.
Introduction to Machine Learning	In this event, we will cover the main pillars of Machine Learning since they are the core of the most recent computer vision methods. For instance, (i) the types of machine learning (supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning); (ii) optimization methods, which refers to the process of fine-tuning a model's parameters to minimize the loss function (Mean Squared Error (MSE) usually used in regression problems, and Cross-Entropy loss typically used in classification problems); (iii) many other components (dataset, evaluation metrics, data pre-processing, etc.)
Machine Learning and Crop Models	A lecture about using crop models in DTs for yield prediction.
Image Classification: From Fully Connected Networks to CNNs. A Weed Detection Approach.	We will study the main differences between fully connected neural networks and CNNs in this event. We will use both architectures to implement a computer vision system, but we will highlight some of the drawbacks that appear while using the first approach. For instance, fully connected networks can become computationally expensive as the number of neurons increases, and they are not ideal for certain types of data where local patterns and spatial hierarchies are important: images.
Image Classification: From CNNs to Transformers. A use case for Weed Identification.	In this event, we will analyze the difference between CNNs and transformers by implementing computer vision systems using both technologies. CNNs are particularly suited for processing grid-like data, such as images, where spatial relationships matter. The CNN architecture uses filters and pooling layers to extract hierarchical features from the data enabling the recognition of complex patterns in the data. However, While CNNs have a fixed receptive field (a limited context window for each element), Transformers have a global receptive field, meaning they can consider the entire context at once. This ability makes Transformers more skillful in handling long-range dependencies, which may be helpful in some image recognition problems.
Transfer Learning for small datasets in Weed Identification	Although we have built ad-hoc architectures (fully connected, CNNs and Transformers) in previous events, this solution cannot scale easily due to the lack of images in the agricultural context. Architectures pushing computer vision systems' performance are trained on millions of images, which is not the case in agriculture. Therefore, reusing those pre-trained architectures and taking advantage of their previous knowledge can be done with a technique called Transfer Learning. The use of this technique in both CNNs and Transformers will be studied and implemented in this event.
Graduate Course: Intro to Machine Learning	A course about using Data with Machine Learning. In this course, the participants will learn how to model patterns and structures contained in data, and evaluate data-driven models, i.e. models that learn directly from observations the phenomena under study
Annotations Strategies and Techniques/Intro to Object Detection	In this course, participants will dive into the world of annotation strategies and techniques, with a specific focus on object detection. With the increasing demand for accurate and efficient annotation of images and videos, this course aims to equip participants with the knowledge and skills to optimize the annotation process using novel techniques and best practices. Participants will be introduced to Computer Vision

	Annotation Tool (CVAT), a powerful annotation platform widely used in the industry. They will learn how to leverage the various features and functionalities of CVAT to efficiently annotate objects of interest in images and videos. The course will cover topics such as setting up annotation tasks, managing annotation projects, and collaborating with other annotators effectively.
Object Detection (Faster R-CNN and YOLO)	In previous events, we have covered a specific problem in computer vision: Image Classification. However, sometimes, apart from classifying an image, it is also necessary to locate the object (or objects) inside of an image. This approach is known as object detection and covers (i) locating the object and (ii) classifying the part of the image where an object was found. In this event, we will provide an introduction to Object Detection, and we will implement and evaluate a detector from the R-CNN family: the Faster R-CNN. Faster R-CNN is not the only object detection architecture that can report good results in several agricultural problems. For instance, another architectural family name YOLO can also provide state-of-the-art results. Therefore, we will cover the YOLO family and its different variants in this event. Specifically, YOLO-NAS and YOLO v8 will be implemented, fine-tuned, and evaluated among other studied architectures.
Improving Performance: Advanced Computer Vision Techniques	In this event, we will delve into some of the latest methods used to achieve top-tier results in machine learning tasks. We will focus on three specific techniques:- Test Time Augmentation: The idea is that during the inference phase, instead of passing a raw test sample through the model once, the test sample is augmented and passed through the model multiple times, and the predictions are averaged (in regression tasks), or a majority vote is taken (in classification tasks) to get the final output. - Knowledge Distillation: This technique entails training a smaller and simpler model, often referred to as the "student" to mimic the behavior of a larger, more complex "teacher" model. The objective is to enable the student model to acquire the "knowledge" of the teacher. - Noisy-Student Training: This method is similar to Knowledge Distillation, but it introduces an element of noise. In this approach, the student is trained on noisy versions of the original images used for the teacher, supplemented with additional images for which the teacher has provided pseudo labels.
Seminar on Reinforcement Learning in a changing climate	A seminar to dive into a recently published paper about CropGym and a demo of the CropGym RL agent applying fertilzer
Workshop on CropGym	A workshop about reinforcement learning and hands on with the CropGym algorithm.
Introduction to mobile robotics with ROS	The lessons will cover the fundamentals of mobile robotics, including the hardware and software components necessary for developing autonomous applications. Participants will learn about the challenges and difficulties associated with mobile robotics and explore the most common architectures used in this field. Additionally, they will be introduced to the Robot Operating System (ROS), a widely used framework, and its various components, functionalities, and advantages. The lessons will culminate in a demo of a ground robot operating in a simulated environment.
Precision agriculture vol1: Fundamentals and Technologies	Precision Agriculture Vol. 1 provides a comprehensive introduction to the fundamental concepts and technologies of precision agriculture. Participants will learn about the principles of data collection, analysis, and interpretation for making informed decisions in crop management. Topics covered include remote sensing, GIS (Geographic Information System), GPS (Global Positioning System), and data-driven decision-

	making techniques. This course lays the groundwork for understanding the role of technology in optimizing agricultural practices.
Precision agriculture vol2: Advanced Crop Monitoring and Management	Precision Agriculture Vol. 2 builds upon the foundational knowledge gained in the first course and delves deeper into advanced crop monitoring and management techniques. Participants will explore advanced sensing technologies such as drones, satellite imagery, and IoT (Internet of Things) devices to collect precise and real-time data about crop health, soil conditions, and environmental factors. They will learn how to leverage this data to optimize resource allocation, implement targeted interventions, and enhance overall crop productivity and sustainability.
Simultaneous Localization and Mapping (SLAM)	We will motivate the need for localization and mapping for a robot to be able to navigate autonomously in a scenario. We will teach about the problems, the architecture, the sensors used and the most common algorithms: kalman filter based, particle filters, and graph based. We will finish with a demo of these algorithms working in a simulated environments in ROS.
Digital Innovations in Arable Farming	The course will aim to explore evidence-based information that highlights the benefits and challenges of adopting new technologies within the EU on arable crops. The course will use as a case study/ good example the implementation of such technologies under the scope of the SmartDroplets project, involving in the process the actors/ end-users of it from Lithuania demonstrator. Hence, the opportunity will be given to the participants to the learn from first hand how to overcome the barriers to adoption and implementation of digital solutions in the arable crops. The main focus areas of the course will be: Sustainable arable farming; Precision agriculture; Data collection technologies; Socio-economics barriers;
Autonomous Navigation for Ground Robots	In this talk, we will teach about the main algorithms used by a robot in order to navigate autonomously. We will start with an explanation of the most used global planning algorithms, and what to do if an obstacle is encountered. We will finish with a demo of an autonomous robot in a simulated environments in ROS.
SD solution demonstrators vol1	The aim of these events (2 in total) will be to demonstrate the SmartDroplets solution to potential end-users and relevant stakeholders by presenting its features in an operational environment. The participants will have the opportunity to improve their knowledge on the concepts of precision agriculture and sustainable intensification and the impact these can have on farming systems, to witness how to use agri-tech to help reduce the environmental impact of farming practices and identify which skills are necessary to implement new data-driven arable farming techniques.
SD solution demonstrators vol2	The aim of these events (2 in total) will be to demonstrate the SmartDroplets solution to potential end-users and relevant stakeholders by presenting its features in an operational environment. The participants will have the opportunity to improve their knowledge on the concepts of precision agriculture and sustainable intensification and the impact these can have on farming systems, to witness how to use agri-tech to help reduce the environmental impact of farming practices and identify which skills are necessary to implement new data-driven arable farming techniques.
Mobile Robotics in Agriculture: lessons learned	In this activity, we will talk about our experience in agricultural robotics, and we will dive deep into which algorithms from classical robotics work for agriculture, which do not, and what we have done to accomplish autonomous robots to perform appropriately in agricultural fields. We

	will finish with lessons learned from the Smart Droplets pilots and developments.
Precision agriculture vol3: Integration and Decision Support Systems	Precision Agriculture Vol. 3 focuses on the integration of various technologies and the implementation of decision support systems in precision agriculture. Participants will learn how to integrate data from multiple sources and platforms, including sensors, machinery, and farm management software, to develop comprehensive farm-level strategies. They will gain insights into using artificial intelligence and machine learning algorithms to analyze complex datasets, generate actionable insights, and automate decision-making processes. This course equips participants with the skills needed to design and optimize precision agriculture systems tailored to their specific agricultural holdings.

Table 4: Smart Droplets Academy (Activity Title, Relation to the Project). Activities in bold characters, have already taken place.

Activity Title	Relation to the project
Introduction to Smart Droplets and Reinforcement Learning	**Reinforcement Learning is the core artificial intelligence technique that used in the Smart Droplets recommendation system. CropGym is a RL-based fertilizer recommendation system that was developed in Wageningen. By participating in this activitiy, the agricultural domain expert gets an idea of how the RL algorithm works and further discusses with the WU team in how to improve CropGym to be deployed in the field.**
Seminar on Reinforcement Learning and CropGym	**Reinforcement Learning is the core artificial intelligence technique that used in the Smart Droplets recommendation system. CropGym is a RL-based fertilizer recommendation system that was developed in Wageningen. By participating in this activitiy, the agronomers gets an idea of how the RL algorithm works and further discusses with the WU team in how to improve CropGym to be deployed in the field.**
Lecture on Reinforcement Learning	Policy approximation is the main RL algorithm used in CropGym. This lecture provides an in depth look into the workings of the PPO algorithm (a popular policy approximation method).
Workshop on Digital Twins	Digital Twins is a core concept in the Smart Droplets project. In this workshop we will share the latest advancements of Digital Twins and also CropGym.
Introduction to Machine Learning	The activity aligns closely with the goals and objectives of the Smart Droplets project. By covering the main pillars of Machine Learning, specifically in the context of computer vision methods, the event directly relates to the project's focus on developing AI anomaly detection systems and optimizing AI models for edge devices. Understanding different types of machine learning, such as supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning, is crucial for the development of AI models within the Smart Droplets project. These models will be trained and optimized to detect anomalies and provide dosage recommendations in real-time using computer vision techniques. The optimization methods mentioned, including fine-tuning model parameters to minimize loss functions such as Mean Squared Error (MSE) and Cross-Entropy loss, are essential for optimizing the performance of AI models deployed in the Smart Droplets system. By fine-tuning the models using these methods, the project aims to achieve high accuracy and real-time performance while operating on edge devices. The activity also mentions various other components such as datasets, evaluation metrics, and data pre-processing. These components are crucial in the development and implementation of AI

	models within the Smart Droplets project. The project relies on curated datasets, appropriate evaluation metrics, and effective data pre-processing techniques to train and assess the performance of the AI models used for anomaly detection and dosage recommendation.
Machine Learning and Crop Models	Crop models are used in DTs for yield prediction. This lecture will dive into how WU does predictions with the crop models and using it in the context of a digital twin.
Image Classification: From Fully Connected Networks to CNNs. A Weed Detection Approach.	The activity directly relates to the goals and objectives of the Smart Droplets project, particularly in the development and implementation of computer vision systems for anomaly detection and optimization of spraying operations. The activity focuses on studying the main differences between fully connected neural networks and convolutional neural networks (CNNs) and their suitability for image processing tasks. Fully connected neural networks: The activity highlights the drawbacks of using fully connected networks for image processing tasks. This is relevant to the Smart Droplets project as it involves analyzing visual data from RGB cameras for anomaly detection and dosage recommendation. By understanding the limitations of fully connected networks, the project can make informed decisions regarding the choice of neural network architectures for effective image analysis. CNNs: The activity emphasizes the importance of CNNs in handling image data due to their ability to capture local patterns and spatial hierarchies. CNNs are specifically designed for image processing tasks and excel at extracting features from images. This aligns with the Smart Droplets project's objective of developing computer vision systems using AI techniques to analyze real-time image feeds and make accurate recommendations for optimizing spraying operations. Computational efficiency: The activity mentions that fully connected networks can become computationally expensive as the number of neurons increases. This is an important consideration for the Smart Droplets project, as the AI models developed for anomaly detection and dosage recommendation need to be efficient and operate in real-time on edge devices. Understanding the computational implications of different network architectures helps in selecting the most suitable approach for the project's requirements.
Image Classification: From CNNs to Transformers. A use case for Weed Identification.	The activity directly relates to the objectives and technological aspects of the Smart Droplets project, which involves developing computer vision systems for anomaly detection and optimization of spraying operations. The activity focuses on analyzing the differences between convolutional neural networks (CNNs) and transformers in the context of computer vision tasks. CNNs and grid-like data: The activity highlights that CNNs are well-suited for processing grid-like data, such as images, where spatial relationships matter. This is highly relevant to the Smart Droplets project as it involves analyzing visual data from RGB cameras to detect anomalies and optimize spraying operations. By utilizing CNNs, the project can effectively extract hierarchical features from images, enabling the recognition of complex patterns and anomalies related to crop health and spraying efficiency. Transformers and global receptive field: The activity mentions that transformers have a global receptive field, allowing them to consider the entire context at once. This characteristic of transformers is particularly useful in handling long-range dependencies in image recognition problems. In the context of the Smart Droplets project, transformers' ability to capture global contextual information can be leveraged to improve the accuracy and effectiveness of anomaly detection and optimization algorithms. It enables the model to understand complex relationships between different parts of the field,

	crop conditions, and spraying requirements. Participants will gain insights into the strengths and limitations of each approach in handling different aspects of image processing and recognition. This knowledge is directly applicable to the Smart Droplets project, as it enables informed decision-making regarding the selection and optimization of AI models for the project's specific objectives, such as detecting anomalies, providing dosage recommendations, and optimizing spraying operations based on real-time image feeds.
Transfer Learning for small datasets in Weed Identification	The described activity directly relates to the challenges faced by the Smart Droplets project in developing computer vision systems for the agricultural context. It addresses the issue of limited image availability in agriculture and proposes a solution using transfer learning with pre-trained architectures. Overall, the activity addresses the scalability and data limitations in the agricultural context by introducing transfer learning as a viable solution. By studying and implementing transfer learning techniques in CNNs and Transformers, the Smart Droplets project can overcome the challenges posed by the scarcity of agricultural images and leverage the power of pre-trained architectures to enhance the performance and effectiveness of their computer vision systems.
Graduate Course: Intro to Machine Learning	Machine learning plays an increasingly important role in many scientific areas, including geo-information science and remote sensing, ecology and engineering. The Smart Droplets project specifically uses various AI technology to process inputs of the farm, either for Machine Vision, or for the recommendation engine. Scientific data are growing in complexity, size, and resolution, and scientists are challenged to leverage available data to inform decision making. The participants will learn how to use deep learning methods for spatial data. In Smart Droplets, deep learning methods are the basis of the recommendation engine and also the way that some variables are processed to be fed into the crop model. The underlying machine learning methods used in the Smart Droplets DT is discussed more elaborately here.
Annotations Strategies and Techniques/Intro to Object Detection	The Annotation Strategies and Techniques/Intro to Object Detection course is highly relevant to the project as it directly addresses the need for accurate and efficient annotation of images and videos, particularly for object detection tasks. By equipping participants with the knowledge and skills to optimize the annotation process using novel techniques and best practices, this course directly supports the project's objective of achieving high-quality annotated datasets.
Object Detection (Faster R-CNN and YOLO)	The activity is directly related to the Smart Droplets project's goals of developing computer vision systems for the agricultural context. It introduces the concept of object detection as an extension to image classification and highlights the need to locate and classify objects within agricultural images. Specifically, the activity focuses on implementing and evaluating a detector from the R-CNN family, the Faster R-CNN, and YOLO which are popular and effective approaches for object detection. The activity addresses the need for object detection in the agricultural context and compares the results of Faster R-CNN and YOLO as a specific technique to achieve this goal. By implementing and evaluating these models, the Smart Droplets project can leverage the advancements in object detection to accurately locate and classify objects within agricultural images, contributing to the optimization of spraying treatments and supporting decision-making processes in the field.
Improving Performance: Advanced Computer Vision Techniques	These cutting-edge machine learning techniques, namely Test Time Augmentation, Knowledge Distillation, and Noisy-Student Training, hold significant relevance and potential within the context of the Smart Droplets project. By exploring these advanced methods during the event,

	we aim to uncover their application in enhancing the performance and efficacy of the Smart Droplets solution.
Seminar on Reinforcement Learning in a changing climate	The seminar focused on a recently published paper on CropGym holds great significance for the Smart Droplets project, as it directly relates to the development and integration of advanced technologies in precision farming. CropGym, being a prominent component of the project, plays a crucial role in optimizing fertilizer management through the application of Reinforcement Learning (RL) techniques.
Workshop on CropGym	The workshop on reinforcement learning (RL) with a hands-on session featuring the CropGym algorithm directly aligns with the objectives and goals of the Smart Droplets project. As a project dedicated to advancing smart farming technologies, the integration of RL techniques, such as those explored in the workshop, plays a pivotal role in optimizing crop management decisions and reducing the usage of chemicals. By delving into the intricacies of RL, participants of the workshop gain a deeper understanding of how this AI method can be applied to enhance farm management practices. The hands-on session with the CropGym algorithm provides a practical opportunity to explore and experiment with RL-based approaches specifically tailored to fertilizer management.
Introduction to mobile robotics with ROS	The mobile robotics activity holds significant importance within the Smart Droplets project. By engaging in this activity, participants will gain familiarity with the world of mobile robotics, with a specific focus on ground robots or rovers—the type of robots utilized in the Smart Droplets project and other similar agricultural initiatives. Acquiring knowledge and skills in mobile robotics will enable participants to be aware of the potential of automation in the agricultural sector. With the assistance of ground robots, tasks within the field can be automated, increasing efficiency and productivity. The lessons on mobile robotics will equip participants with the necessary understanding of hardware and software components, as well as common architectures, to develop autonomous applications for agriculture. Furthermore, the introduction to the Robot Operating System (ROS) is particularly valuable. ROS is a robust and widely adopted framework that offers a set of functionalities for developing sophisticated robotic systems. Being well-versed in ROS will empower participants to leverage its capabilities in designing solutions for agriculture.
Precision agriculture vol1: Fundamentals and Technologies	The Precision Agriculture Vol. 1 course is essential to the project as it provides participants with a comprehensive introduction to the fundamental concepts and technologies of precision agriculture. By covering topics such as remote sensing, GIS, GPS, and data-driven decision-making techniques, participants gain a solid foundation in understanding how technology can optimize agricultural practices. This knowledge is directly applicable to the smart agriculture and digital transformation projects pursued by companies in the sector. Participants will learn the principles of data collection, analysis, and interpretation, enabling them to make informed decisions in crop management. By mastering these foundational concepts, participants will be well-prepared to integrate cutting-edge technologies into their agricultural holdings, combining traditional agronomic knowledge with the application of modern tools and techniques. The course sets the stage for participants to become effective contributors to the advancement of smart agriculture and digital transformation initiatives within the agricultural sector.
Precision agriculture vol2: Advanced Crop Monitoring and Management	The Precision Agriculture Vol. 2 course plays a major role in relation to the overall project by building upon the foundational knowledge gained in the first course and providing participants with advanced crop

	monitoring and management techniques. By exploring advanced sensing technologies such as drones, satellite imagery, and IoT devices, participants will acquire the skills to collect precise and real-time data on crop health, soil conditions, and environmental factors. This data will be invaluable for optimizing resource allocation, implementing targeted interventions, and ultimately enhancing overall crop productivity and sustainability. By leveraging these advanced techniques, participants will be equipped to make data-driven decisions and improve the efficiency and effectiveness of their agricultural practices. The course ensures that participants are well-prepared to contribute to the smart agriculture and digital transformation projects of companies in the sector, ultimately driving innovation and progress in the field of precision agriculture.
Simultaneous Localization and Mapping (SLAM)	The Simultaneous Localization and Mapping activity is relevant in the context of the project, more specifically linked to WP4: Autonomous Spraying System. Participants of this activity will become familiar with the Simultaneous Localization and Mapping algorithms (and how they work), used in the Smart Droplets project to enable autonomous navigation of the tractors. The activity focusing on localization and mapping for autonomous robot navigation holds significant importance within the Smart Droplets project. By highlighting the necessity of accurate localization and mapping for a robot, participants will gain a deeper understanding of the challenges and requirements specific to the project's objectives. In the context of Smart Droplets, the ability of robots to navigate autonomously is crucial for their effective operation in agricultural fields. Accurate localization enables the robots to precisely determine their position within the environment, while mapping allows them to create a representation of the surroundings. These capabilities are essential for tasks such as targeted spraying, path planning, and data collection, as they require robots to navigate autonomously and make informed decisions based on their understanding of the environment. By teaching about the problems, architecture, sensors, and common algorithms used in localization and mapping, participants will acquire valuable knowledge and skills to contribute to the development of autonomous agricultural mobile robots
Digital Innovations in Arable Farming	The objectives of the coure are fully alligned with the key objectives of the project as well; more precisely, the course will highlight the fact that the intensification of arable farming systems can be achieved only through the adoption of innovative technologies, without negatively impacting the environment.
Autonomous Navigation for Ground Robots	The Autonomous Navigation activity is relevant in the context of the project, more specifically linked to WP4: Autonomous Spraying System. Participants of this activity will become familiar with the autonomous navigation algorithms (global and local), used by a robot in order to travel from an origin to a destination successfully. By providing insights into these algorithms and their practical application, participants will gain a deeper understanding of how autonomous robots can navigate effectively in agricultural environments. The ability of robots to navigate autonomously is a critical aspect of the Smart Droplets project. Efficient and reliable navigation is essential for tasks such as precise spraying, monitoring, and data collection. By teaching about the main global planning algorithms, participants will learn about the methodologies employed by autonomous robots to plan their paths and navigate through different agricultural scenarios. Participants gain essential knowledge about global planning algorithms, obstacle avoidance strategies, and practical implementation in simulated environments. Equipped with this understanding, they can actively contribute to the

	development and optimization of autonomous navigation systems agriculture, ultimately enhancing the efficiency and effectiveness of agricultural operations.
SD solution demonstrators vol1	The demonstartion events will provide a first-hand experience to the participants on the impact that the adoption and implementation of precision agriculture digital innovative technologies (hardware and software) can have to the arable farming practices and systems.
SD solution demonstrators vol2	The demonstartion events will provide a first-hand experience to the participants on the impact that the adoption and implementation of precision agriculture digital innovative technologies (hardware and software) can have to the arable farming practices and systems.
Mobile Robotics in Agriculture: lessons learned	This activity focuses on the experience in agricultural robotics and exploring the applicability of algorithms from classical robotics to the agricultural domain, holding great significance within the Smart Droplets project. By delving into the effectiveness of different algorithms in agricultural settings, participants will gain valuable insights into the challenges and requirements specific to this field. Understanding which algorithms work and which do not in the agricultural context is crucial for the successful development of autonomous robots within the Smart Droplets project. Agriculture presents unique challenges such as rough terrain, large areas and environmental factors that can impact the performance of robotic systems. By analyzing the experiences and lessons learned, participants can gain valuable knowledge about the specific algorithms and approaches that have proven effective in similar scenarios.
Precision agriculture vol3: Integration and Decision Support Systems	The Precision Agriculture Vol. 3 course plays a crucial role in relation to the overall project by providing participants with the necessary skills and knowledge to effectively integrate various technologies and implement decision support systems in precision agriculture. By learning how to integrate data from multiple sources such as sensors, machinery, and farm management software, participants will be able to develop comprehensive farm-level strategies that optimize resource allocation and enhance overall efficiency. The course also emphasizes the use of artificial intelligence and machine learning algorithms to analyze complex datasets, generate actionable insights, and automate decision-making processes. With these skills, participants will be equipped to design and optimize precision agriculture systems that are specifically tailored to their own agricultural holdings, thereby facilitating the successful implementation of smart agriculture and digital transformation projects in the sector.

4. Reporting of Activities

As already mentioned above, two Smart Droplets Academy activities hosted by WU had already taken place giving a head start for the academy.

Introduction to Smart Droplets and Reinforcement Learning

Date: 17/02/2023

Location: Wageningen University and Research, Gaia building, Droevendaalsesteeg 1, Wageningen 6708PB, The Netherlands

Number of participants: 3

Target group: Agricultural Experts and Industry (COO of Agrokoncernas and Head Dept. of Agronomy)

D2.3 Smart Droplets Academy – Program, Timeline & Activities

Description: The first Smart Droplets Academy activity, hosted by Wageningen University (WU), held a specialized training event tailored to the needs of Agrokoncernas, a key partner in the Smart Droplets project. This academy event, conducted on **17th February 2023**, aimed to provide Agrokoncernas with a deeper understanding of the AI methods and models employed in farm management decisions, specifically related to spraying and fertilizer application for the upcoming wheat pilot.

Agenda:

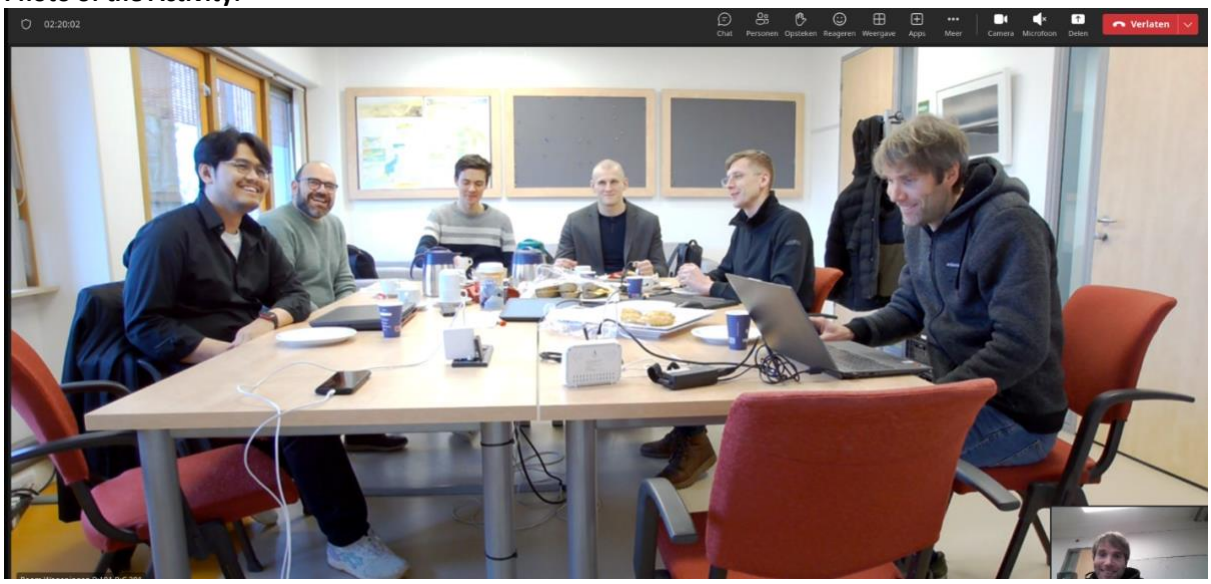
- **12:00-13:00** Introduction and lunch: The event commenced with an introduction session, where participants were welcomed and provided with an overview of the day's agenda. A networking lunch allowed attendees to engage in informal discussions, fostering a collaborative environment.
- **13:15-14:00** Introduction Agrokoncernas: As a key participant in the Smart Droplets project, Agrokoncernas had an opportunity to present their company and provide insights into their farming practices. This session facilitated a better understanding of Agrokoncernas' requirements and challenges in implementing advanced technologies.
- **14:15-16:00** Presentation and demo WUR "Precision farming with reinforcement learning and digital twins": WU experts delivered a comprehensive presentation and live demonstration on precision farming techniques utilizing reinforcement learning and digital twins. Participants gained valuable knowledge about the underlying AI methods and models used in farm management decision-making processes. The session shed light on the applications of reinforcement learning and its potential for optimizing fertilizer management, with a particular focus on the CropGym program—a WU-developed RL agent for fertilizer management.
- **16:00-16:30** Mix and Match: The event concluded with an in-depth discussion session, enabling WUR and Agrokoncernas to "mix and match" their respective needs and goals concerning the deployment of the wheat pilot within the Smart Droplets project. The discussion aimed to align concepts, solutions, and practical approaches to ensure a successful implementation of advanced technologies in Agrokoncernas' farming practices.

Learning Kit: As part of the Smart Droplets Academy, a recorded lecture of the event is available in the Smart Droplets project folder, and it will be soon accessible through Smart Droplets Knowledge Base in the project's official website. The specific link for the Smart Droplets Knowledge Base will be available in the updated version of this Deliverable in M20. Participants can access and review the lecture to reinforce their understanding of the topics covered. Additionally, a tailored learning kit, focused on Reinforcement Learning, Crop Models, and CropGym, has been provided to the participants. The learning kit includes a notebook available at the following link: Learning Kit Notebook. This resource allows participants to delve deeper into the intricacies of the discussed topics and gain hands-on experience with reinforcement learning and crop modeling.

Conclusion: The first Smart Droplets Academy activity at Wageningen University successfully provided Agrokoncernas with crucial insights into AI methods and models used in farm management decisions, specifically focusing on spraying and fertilizer application in preparation for the wheat pilot. The academy facilitated knowledge exchange, fostering collaboration between WU and Agrokoncernas, ensuring a seamless integration of cutting-edge technologies in real-field conditions. By equipping Agrokoncernas with an in-depth understanding of AI-driven methodologies, the academy empowered them to make informed decisions and leverage the Smart Droplets solution effectively.

D2.3 Smart Droplets Academy – Program, Timeline & Activities

Photo of the Activity:



Seminar on Reinforcement Learning and Crop Gym

Date: 11/05/2023

Location: Wageningen University and Research, Radix building, Droevendaalsesteeg 3, Wageningen 6708PB, The Netherlands

Number of participants: 20

Target group: Researchers, Modelers, Agronomists, PhD students

Introduction: As part of the Smart Droplets Academy initiative, a seminar on Reinforcement Learning was organized at Wageningen University (WU). This internal seminar aimed to educate researchers, modelers, and agronomists who were not familiar with AI methods in their work. The seminar focused on introducing the concepts of Reinforcement Learning and CropGym to demonstrate how AI can make informed decisions in farm management scenarios. The event concluded with an in-depth discussion session, encouraging active participation and soliciting suggestions for the Smart Droplets project.

Agenda:

- **Presentation of Reinforcement Learning and CropGym (15:00-15:50):** The seminar began with a comprehensive presentation on the fundamentals of Reinforcement Learning and its applications in the agricultural domain. WUR experts elucidated the principles and techniques involved in Reinforcement Learning, showcasing its potential for enhancing farm management decisions. The CropGym program, specifically designed for agricultural applications, was introduced as a powerful tool for optimizing crop care practices through AI-driven approaches.
- **Discussion and Suggestions for the Smart Droplets Project (15:50-onwards):** Following the presentation, a dedicated session for discussion and suggestions was conducted, involving agronomists, researchers, and other participants. The open forum provided a platform for meaningful interactions, encouraging the exchange of ideas, perspectives, and potential contributions to the Smart Droplets project. Participants were encouraged to provide insights, share their expertise, and propose suggestions that could enhance the project's outcomes and practical implementations.

Learning Kit: As part of the Smart Droplets Academy, a learning kit was prepared to support participants in their understanding of the seminar's topics. The presentation slides from the seminar will be available through the Smart Droplets Knowledge Base of the project's official website. The specific link for the Smart Droplets

D2.3 Smart Droplets Academy – Program, Timeline & Activities

Knowledge Base will be available in the updated version of this Deliverable in M20. These slides serve as a valuable resource, allowing participants to revisit the key concepts and reinforce their understanding of Reinforcement Learning and its application in farm management.

Conclusion: The Reinforcement Learning seminar on changing climate conducted at Wageningen University provided a significant learning opportunity for researchers, modelers, agronomists, and PhD students involved in the Smart Droplets project. The seminar effectively introduced the concepts of Reinforcement Learning and CropGym, showcasing the potential of AI in decision-making processes related to farm management. The interactive discussion session allowed for a collaborative exchange of ideas, resulting in valuable suggestions and contributions towards the Smart Droplets project's success.

The availability of the learning kit, including the presentation slides, ensures that participants can continue to leverage the knowledge gained during the seminar, fostering ongoing learning and development in the field of AI-driven farm management.

Photo from the event:

5. Conclusions and Next Steps

The deliverable titled "Smart Droplets Academy - Program, Timeline & Activities" serves as a comprehensive document that provides a clear roadmap for the training program within the Smart Droplets HE project. It aligns the activities with the key features of the Smart Droplets solution, promotes transparency, and allows for continuous updates to ensure the program's effectiveness throughout the project's lifespan (**M10**, M20 and M32). Its purpose is to provide an in-depth overview of the program's agenda, timeline, and activities, ensuring transparency and continuous updates throughout the project's lifespan. Throughout the project's timeline, the deliverable serves as a living document that can be continuously updated to reflect any changes or adjustments in the program. This ensures that all stakeholders are well-informed about the latest developments and modifications to the training program.

It highlights the integration of various activities under the Smart Droplets Academy, emphasizing their alignment with the key features of the Smart Droplets solution, including AI, Digital Farm Twins, Deep Learning Tools, Retrofit Tractor and DIS (intelligent spraying tools), Autonomous Navigation and Data Storage Tools.

By emphasizing the integration of activities under the Smart Droplets Academy, the document highlights the holistic approach taken towards training and capacity-building. This approach ensures that participants in the project gain comprehensive knowledge and skills that cover various aspects of the Smart Droplets solution, resulting in a well-rounded understanding of the technology and its practical applications.

The next steps for the Smart Droplets Academy program within the Smart Droplets HE project involve the execution and implementation of the outlined activities and timeline. Here are the key next steps:

1. **Program Execution:** Initiate the training program according to the outlined agenda and activities. Ensure that the necessary resources, trainers, and facilities are in place to conduct the training sessions effectively.
2. **Training Delivery:** Conduct the training sessions, workshops, and practical exercises as planned in the program. Focus on providing hands-on experience and practical knowledge to participants, enabling them to understand and utilize the various features of the Smart Droplets solution.
3. **Collaboration and Knowledge Sharing:** Foster collaboration among participants, trainers, and stakeholders involved in the Smart Droplets HE project. Encourage knowledge sharing and exchange of experiences to leverage collective expertise and drive innovation in the field of smart agriculture.
4. **Iterative Updates:** Continuously update the "Smart Droplets Academy - Program, Timeline & Activities" deliverable to reflect any changes, lessons learned, or improvements made throughout the project, namely in M20 and M32. This ensures that the document remains up to date and serves as a valuable resource for stakeholders.
5. **Long-term Sustainability:** Plan for the long-term sustainability of the Smart Droplets Academy program beyond the project's lifespan. All the material of the Smart Droplets Academy will be stored in the Smart Droplets Knowledge Base, which will be hosted in the Smart Droplets official website.

By diligently executing these next steps, the Smart Droplets Academy program can effectively train participants, promote knowledge sharing, and contribute to the successful implementation and adoption of the Smart Droplets solution.