SPARKLE

Sustainable Precision Agriculture: Research and Knowledge for Learning how to be an agri-Entrepreneur

Final "Agripreneurs4.0 Educational Packages"

WP4 (R4.4)

Partner(s)

Co-funded by the Erasmus+ Programme of the European Union

TABLE OF CONTENTS

1. INTRODUCTION

The learning materials of the SPARKLE eLearning Platform have the following essential characteristics:

- free to access
- clear division of topics
- all materials are in English
- materials are composed of various media

(video lectures; texts; slides; embedded quick tests and quizzes and Final tests to verify learning effects related to the contents of each module).

The full Moodle platform and related additional resources can be found at the following link: http://sparkle-project.eu/moodle/

2. DEVELOPMENT OF EDUCATIONAL PACKAGES

The development of educational packages follows and fits the requirements of the moodle e-Learning platform:

- Elaborates the technical architecture of the e-learning platform
- Design and implements the content on the e-learning platform
- Integrates the specific modules in the e-learning platform
- Implements all the corrections obtained through the previous steps
- Provides guidelines for using the e-learning platform.

The main goal of the educational packages is to engage learners with the content of the course.

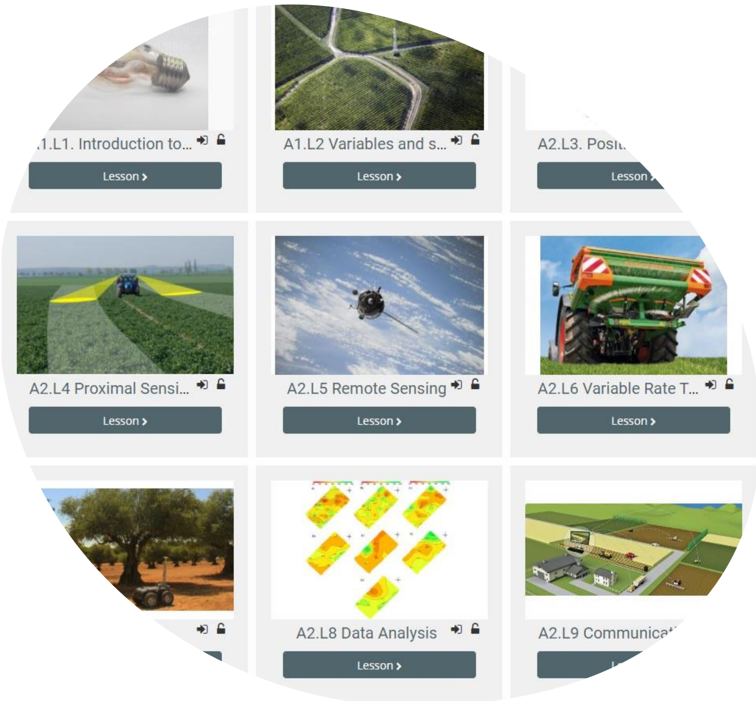
3. EDUCATIONAL PACKAGES STRUCTURE

3.1 AREAS

SPARKLE eLearning Platform educational packages are divided into 4 main areas. The 4 Areas include 12 Lessons and in total 56 Topics. Area AREA 1 - SPA OVERVIEW includes 2 Lessons, AREA 2 - TECHNOLOGY includes 7 Lessons, AREA 3 - SOCIAL AND ECONOMIC ASPECTS includes 1 Lesson and finally AREA 4 - ENTREPRENEURSHIP IN FARMING includes 2 Lessons. Also there is one TRAINING Lesson.

3.2 LESSONS

In the following paragraphs are presented the 12 Lessons of the SPARKLE eLearning Platform.



A1.L1. INTRODUCTION TO SPA

The lesson is divided in to 6 topics:

1. Agriculture historical steps towards Sustainable Precision Agriculture
2. Definition of SPA
3. The digital revolution in agriculture: why we talk about a new paradigm
4. Tech innovation systems in agriculture
5. Economic, environmental and social challenges
6. Future trends: businness view and high tech

A1.L2 VARIABLES AND SYSTEMS

The lesson is divided in to 4 topics:

1. The soil-water-plant agrisystem:a little about soil, water and plants
2. Value chain system in agriculture: role of SPA
3. Arable crops production cycle with SPA technologies
4. Vineyards production cycle with SPA technologies

A2.L3. POSITIONING SYSTEMS

The lesson is divided in to 2 topics:

1. Positioning systems: GNSS
2. Positioning systems: Machinery guidance

A2.L4 PROXIMAL SENSING

The lesson is divided in to 4 topics:

1. Sensors for crop productivity, Yield maps.
2. Proximal vegetation sensors
3. Soil sensors
4. Noded and sensors for multipoint data collection

A2.L5 REMOTE SENSING

The lesson is divided in to 2 topics:

1. Satellite imagery for SPA
2. Remote sensing

A2.L6 VARIABLE RATE TECHNOLOGY

The lesson is divided in to 4 topics:

1. Variable rate seeding
2. Variable rate fertiliser application
3. Variable rate spraying
4. Variable Rate Irrigation (VRI)

A2.L7 ROBOTICS

The lesson is divided in to 4 topics:

1a. Robotics: Introduction
1b. Robotics: Mobility
2. Robotics: Manipulation
3. Robotics: Fleets

A2.L8 DATA ANALYSIS

The lesson is divided in to 3 topic:

1. Basics of geostatistical analysis with GIS
2. Principles of data consolidation
3. Modelling approach for data analysis

A2.L9 COMMUNICATIONS

The lesson is divided in to 3 topics:

1. Electronic Systems for Data Transfer and Command
2. Telemetry and farm fleet management
3. Internet of Things in agriculture

A3.L10 POLICY AND MANAGEMENT

The lesson is divided in to 11 topics:

1. CAP Legislation and SPA
2. How to start or be in a Union or Cooperative?
3. Legislative Constraints
4. Legal constraints on technologies
5. Stage of Development, Technology readiness levels (TRL)
6. Data sharing who is the owner? Who will use it?
7. Legislation of the EU on organic cultivation.
8. Quality Assurance for Food
9. Climate Change
10. Social Leadership: Community management online/offline, Dissemination of the manager concept, Rules for pitching and public speaking how to approach farmers,
11. Introduction, Definition, Examples (Social networks, Value Chains) - Sharing is caring, Develop hub for SPA, Flexible methodologies, Hubs or Clusters innovation facilitators, Social aspects of SPA, social networks, value chain agreement

A4.L11 ENTREPREUNERSHIP IN SPA

The lesson is divided in to 8 topics:

1. Vision and Mission
2. Business Model Canvas
3. Lean Management in SPA
4. Local Ecosystem Key Actors
5. Identikit and features of the "successful" entrepreneur
6. Foresight Analysis
7. Business Plans
8. Entrepreneurship in the value chain: case study from Rezos

A4.L12 TOOLKIT FOR AGRIPREUNERS 4.0

The lesson is divided in to 5 topics:

1. Principles of Farm Management
2. Innovation Processes
3. What to do with data?
4. Software for Farmers - FMIS
5. Study Cases (web)

3.3 TOPICS CONTENT

A1.L1.1 AGRICULTURE HISTORICAL STEPS TOWARDS SUSTAINABLE PRECISION AGRICULTURE

DOI 10.36253/978-88-5518-044-3.01

Sequence ID: 1

The term precision agriculture were introduced into scientific literature by Jhon Schueller in the 1991 Meeting of the American Society of Agricultural Engineers (ASAE) in Chicago: "the continuous advantages in automation hardware and software technology have made possible what is variously knows as spatially-variable, or site specific crop production".

The concept of sustainable development was introduced in 1987 in the Bruntland Report and the term "sustainable agriculture" was defined in the 5th European Environmental action programme: Towards sustainability. In Agenda 2000, 5 main objectives founded Common Agricultura Policies toward 2020: competitiveness; food safety and quality; farmers' wellness and proper income; environmental respect; new jobs opportunities for farmers' communities

A1.L1.2 DEFINITION OF SPA

DOI 10.36253/978-88-5518-044-3.02

Sequence ID: 2

Some examples of SPA definitions are presented, including the most recent definition released by the International Society of Precision Agriculture (ISPA). The SPARKLE definition of SPA is presented, with a list of all the keywords used to accomplish that definition. The three dimensions of Precision Agriculture (Economy, Agronomy and Technology) and their relative weight are discussed. Materials for this topic include a presentation and a text, that are complementary.

A1.L1.3 THE DIGITAL REVOLUTION IN AGRICULTURE: WHY WE TALK ABOUT A NEW PARADIGM

DOI 10.36253/978-88-5518-044-3.03

Sequence ID: 3

The new paradigm of digitization and high technologies is considered fundamental in the next CAP that aims to foster effectively the 5 goals of sustainability:

- increasing competitiveness;
- assuring food safety and quality;
- maintaining a fair standard of living for agricultural communities
- stabilizing farm incomes;
- better integrate environmental goals into CAP;
- develop alternative job and income opportunities for farmers and their families.

Climate change makes essential to strongly implement the approach to a Sustainable Precision farming and the development of all innovative technologies that must be appropriate and scaled in the specificity of the business model that can be pursued by an agri-entrepreneur.

Digitization, connectivity and high technology of agriculture 4.0

A1.L1.4 TECH INNOVATION SYSTEMS IN AGRICULTURE

DOI 10.36253/978-88-5518-044-3.04

Sequence ID: 4

The technological models related to farm machinery have had a different evolution in relation to structural and social conditions. Thus we have the American - Western model, capital intensive, with large machines and at the opposite the Asian model, labor intensive, with small and sophisticated machines suitable for small and family farms.

Even if, in the large scale machinery, the implementation of new technologies requires less investment in percentage, all farm technical management system may have advantages by the new technology: a) measuring parameters and processes, b) assessing data by informatics models giving information optimization c) availabilit6y of tools to manage the single specific resource. That is Precision Farming.

A1.L1.5 ECONOMIC, ENVIRONMENTAL AND SOCIAL CHALLENGES

DOI 10.36253/978-88-5518-044-3.05

Sequence ID: 5

The new paradigm of digitization, connectivity and Precision Agriculture is a great opportunity in growing on work efficiency and profitability, resources and environment care, social evolution in new jobs and in a new way of working. However, this widespread adoption require time in appropriate machines, devices, systems and procedures. In the different stage of complexity, economic and environmental advantages are already defined in an important document of the European Parliament (STOA 2016 and 2017) i.e.

The first step of PA adoption saves time and fuel for 15-20%, new conservative operation reduces soil erosion up to 15 times, more complex steps make saving up to 70% of chemicals for pest control. Nevertheless, problems arise with education and training.

A1.L1.6 FUTURE TRENDS: BUSINNESS VIEW AND HIGH TECH

DOI 10.36253/978-88-5518-044-3.06

Sequence ID: 6

This topic presents the macro-design of SPA that will surely appear in the coming years and also the future technological trends in SPA applied to viticulture and arable crops. A vision of the future of SPA is presented in three layers:

i) human intelligence (related to soil, plants, climate, pests, diseases, environment, food production, fibre and energy) on top;

ii) artificial intelligence (related to hardware, communications, data) in the middle;

iii) and again human intelligence on the bottom (consumers, business models, transparency, food traceability).

"Big Data" challenges are discussed regarding the specific needs of agriculture. The technological groups identified in a Foresight Analysis report are discussed and the future technological trends on arable crops and vineyards are presented.

In this topic, materials include a slide presentation, a document text and the Foresight Analysis report.

A1.L2.1 THE SOIL-WATER-PLANT AGRISYSTEM:A LITTLE ABOUT SOIL, WATER AND PLANTS

DOI 10.36253/978-88-5518-044-3.07

Sequence ID: 7

Soil and water are essential for plants to grow. By analysing a Vegetation Index map of a corn field after emergency we are going to observe different concentrations of chlorophyll across the field. We will try to identify possible causes for those differences and discuss the strategies to solve any problems that are occurring. These problems can be related with soil characteristics, irrigation, plant germination capacity, nutrition, etc., highlighting the importance of soil-water-plant agrisystem.

The materials for this topic are a presentation and a text.

A1.L2.2 VALUE CHAIN SYSTEM IN AGRICULTURE: ROLE OF SPA

DOI 10.36253/978-88-5518-044-3.08

Sequence ID: 8

A value chain consists of the actors (private and public, including service providers) and the sequence of value-adding activities involved in bringing a product from production to the end-consumer. In agriculture they can be thought of as a "farm-to-fork" set of inputs, processes and flows. Agricultural businesses in developing countries offer an opportunity for market based economic development that creates benefits throughout value chains. Sustainable development in agricultural value chains of emerging economies could be of high relevance of Sustainable Precision Agriculture.

A1.L2.3 ARABLE CROPS PRODUCTION CYCLE WITH SPA TECHNOLOGIES

DOI 10.36253/978-88-5518-044-3.09

Sequence ID: 9

Three case study situations are presented and analysed in this topic about rice and corn production cycle.

The materials created include:

i) A video describing rice production cycle in Portugal, using SPA technologies. This video shows the terrain preparation, sowing, herbicide and fertilizers application and harvesting, explaining all the operations;

ii) A presentation of a case study, also about rice production, describing other important issues related to the use of SPA, like determining soil fertility and nutrient needs, relationships between NDVI and productivity, smart sampling, crop monitoring, net income analysis and ways to improve productivity.

iii) A presentation showing the use of several SPA technologies in corn production complemented with a text document.

A1.L2.4 VINEYARDS PRODUCTION CYCLE WITH SPA TECHNOLOGIES

DOI 10.36253/978-88-5518-044-3.10

Sequence ID: 10

The use of Precision Agriculture in the vineyard chain has had a strong evolution over the last years, due to the need to risks control derived by pest and climate change. The great variability of the specific environment, dimension and infrastructure have determined more research development than market ready technologies, in comparison with what is happened in tillage crops. In viticulture, pest and climate dangerous event risk control, with IoT technologies is the core of innovation, then there is the vigour control of the vines by monitoring an agronomical management.

For the high value chain of wine traceability and sustainability, key indexes are fundamental.

Digital and high tech territorial platforms are essential to increase PA technologies acquisition in grape and wine value chain.

A2.L3.1 POSITIONING SYSTEMS: GNSS

DOI 10.36253/978-88-5518-044-3.11

Sequence ID: 11

This topic will provide an overview of the technologies available for georeferencing machinery or any agricultural equipment on the Earth's surface. Principles of GNSS (global navigation satellite systems) will be presented, along with current satellite constellations such as NAVSTAR GPS, GLONASS, Beidou, Galileo, etc. Error correction based on SBAS services and RTK technology. RTK networks. Definition of static and dynamic errors and accuracy.

A2.L3.2 AUTOMATED GUIDANCE OF AGRICULTURAL MACHINERY

DOI 10.36253/978-88-5518-044-3.12

Sequence ID: 12

In modern agriculture, tractors have been fitted with accessories and technologies to help the tractor guidance. In this topic, these technologies will be explained describing different possibilities for the adoption of farm machinery guidance aids. Differences between systems helping the guidance and autosteering systems will be defined, along with current state of legislation concerning unmanned vehicles. Levels of precision in the track of the machinery will be explained, related with the GNSS technology onboard. Consequences of a better tractor guidance on farm tasks and economy will be outlined

A2.L4.1 SENSORS FOR CROP PRODUCTIVITY, YIELD MAPS.

DOI 10.36253/978-88-5518-044-3.13

Sequence ID: 13

For gathering the final results of a season-round crop work, the georeferenced yield is a key piece of information. Harvesting equipment can be equipped with sensors to gather such information. Systems based on different technologies (impact, volume, optics, density, gravity…) will be explained for recording the yield flow inside the machinery, during the harvesting. Adaptations of yield sensors depending on the commodity, along with new sensing systems will be discussed. Sensor for quality quantification will also be explained, as they are important for certain crops. Basic procedures for the calibration of the sensing system and the proper registration of yield data to generate a successful yield map are presented.

A2.L4.2 PROXIMAL VEGETATION SENSORS

DOI 10.36253/978-88-5518-044-3.12

Sequence ID: 14

In this topic the basic principles of sensors to gather information about plant status are explained. Mainly optical sensors, but also systems based or other principles, vegetation sensors will be presented as well as their use to register information about crop health, physiological activity, possible pest infestation, water content, and so on. Information acquired by these sensors (normally optical signals) must be processed adequately and, in many cases, converted into vegetation indexes that will be presented for different cases of usage.

A2.L4.3 SOIL SENSORS

DOI 10.36253/978-88-5518-044-3.15

Sequence ID: 15

Sensors for estimation of soil properties will be explained in this topic. Principles about soil sensors based on different technologies (electroconductivity, magnetic response, NIR optical signals, mechanical resistance…) will be presented. Relation between these sensors and soil attributes related to fertility are important in order to extract relevant agronomical information out of soil maps.

A2.L4.4 NODED AND SENSORS FOR MULTIPOINT DATA COLLECTION

DOI 10.36253/978-88-5518-044-3.16

Sequence ID: 16

In this topic the technologies realted to wireless sensor networks (WSN) will be presented. The different parts of the network (nodes, gateway, data transfer protocols...) will be explained, as well as the sensors themselves (sensors for soil humidity, temperature, presure, precipitation, crop physiology, pest detection, etc.)

A2.L5.1 SATELLITE IMAGERY FOR SPA

DOI 10.36253/978-88-5518-044-3.17

Sequence ID: 17

Satellite imagery is a simple and scalable support tool for crop monitoring which allows advanced remote management of a large number of hectares. It offers to agricultural technicians' free information a reasonable resolution. We will analyze advantages and disadvantages as well as the main application and sources of satellite images.

A2.L5.2 REMOTE SENSING

DOI 10.36253/978-88-5518-044-3.18

Sequence ID: 18

Unmanned Aerial Vehicles (UAVs) are becoming a common tool in Precision Agriculture. Combined with different sensors and devices, UAVs can be capturing high geo-referenced resolution images and enable the acquisition of real-time crop-related data. We will go through the main typologies and characteristics of UAVs, different sensors and utilities and other applications of UAVs in agriculture.

A2.L6.1 VARIABLE RATE SEEDING

DOI 10.36253/978-88-5518-044-3.19

Sequence ID: 19

In this topic, the principles of the modulation of the seeding/planting dose (seeds or plants put in the soil, per square meter) will be explained.Consequences on plant growth and final crop yield. Advantages and disadvantages of the application of such technologies, along with the electronics systems aborad the machinery capable of performing such variable dosing will be presented.

A2.L6.2 VARIABLE RATE FERTILISER APPLICATION

DOI 10.36253/978-88-5518-044-3.20

Sequence ID: 20

In this topic, the principles of the modulation of the fertiliser dose (liters or kilograms put in the soil, per square meter) will be explained. Consequences on plant growth and final crop yield. Advantages and disadvantages of the application of such technologies, along with the electronics systems abroad the machinery, capable of performing such variable dosing will be presented.

A2.L6.3 VARIABLE RATE SPRAYING

DOI 10.36253/978-88-5518-044-3.21

Sequence ID: 21

In this topic, the principles of the modulation of the pesticide dose (liters or kilograms put ion the crop, per hectare) will be explained. Consequences on pest control, cost and final crop yield. Advantages and disadvantages of the application of such technologies, along with the electronics systems abroad the machinery, capable of performing such variable dosing will be presented.

A2.L6.4 VARIABLE RATE IRRIGATION (VRI)

DOI 10.36253/978-88-5518-044-3.22

Sequence ID: 22

Many types of technology are used in variable rate application for Precision Agriculture. In this case, we are talking about Variable Rate Irrigation technology.

Materials for this topic include a presentation and a text, that are complementary.

A2.L7.1A ROBOTICS: INTRODUCTION

DOI 10.36253/978-88-5518-044-3.23

Sequence ID: 23a

Introduction: This topic is the first of 4 Robotics topics, and contains a short introduction on what robotics is, its definition, and how it can help agriculture (in SPA). It will also lay the framework for the following topics within the lesson.

A2.L7.1B ROBOTICS: MOBILITY

DOI 10.36253/978-88-5518-044-3.23

Sequence ID: 23b

Mobility: This topic will use the framework introduced in the introduction to explain what mobility means, and what design choices are made for field operation. It will briefly discuss different sensing techniques, and will go in more depth on how a robot may use sensory input to make appropriate decisions for basic navigation as well as object avoidance. Finally, it will discuss path planning and its difficulties.

A2.L7.2 ROBOTICS: MANIPULATION

DOI 10.36253/978-88-5518-044-3.25

Sequence ID: 24

This topic will talk about the different ways in which robotics can interact with its environment. It will dive into different actions necessary such as seeding, weeding, picking, spraying. It will not discuss the mechanical aspects in high details, but will be more in depth about the use of sensors and the decision making and reasoning of the way of work.

It will also discuss the choices that need to be considered while designing for specific applications.

Then this topic will also briefly mention data and monitoring applications, where the focus is mainly on the software capabilities, and not the hardware.

A2.L7.3 ROBOTICS: FLEETS

DOI 10.36253/978-88-5518-044-3.026

Sequence ID: 25

This topic will talk about the application of fleet robotics in agriculture. It will discuss the need for communications and the different strategies that could be implemented.

It will also take a close look at how multi-robot systems are managed and supervised, as well as explain different planning strategies.

The differences of centralised vs decentralised decision making will be explained, and an explanation of a graphical user interface will also be discussed.

A2.L8.1 BASICS OF GEOSTATISTICAL ANALYSIS WITH GIS

DOI 10.36253/978-88-5518-044-3.27

Sequence ID: 26

The goal of Geostatistic is to predict the spatial distribution of a property.

In this topic we are going to study two types of Spatial Analysis:

i) Conventional Analysis (Nongeostatistical);

ii) Spatial Continuity Analysis (Geostatistical).

We will also try to understand what are Experimental variograms (Nugget; Range and Sill), Variogram models (basic variogram functions) and Estimation (Kriging).

The video includes an Exercise.

The materials for this topic are a slide presentation, a video with an exercise resolution using geostatistics and two guidebooks.

A2.L8.2 PRINCIPLES OF DATA CONSOLIDATION

DOI 10.36253/978-88-5518-044-3.28

Sequence ID: 27

Gathering data from different sources and with different cadence (sampling frequency) is normal in Precision Agriculture. However, the consolidation of those sources of information in a well structured, homogeneous database in sometimes a difficult task. In this topic, the principles of a successful data gathering and consolidation process will be explained.

A2.L8.3 MODELLING APPROACH FOR DATA ANALYSIS

DOI 10.36253/978-88-5518-044-3.29

Sequence ID: 28

A Decision Support System (DSS) is an interactive, computer-based system that helps users in making decisions. Besides the provision of storing and data retrieval, DSS enhances information access and retrieval functions. Designing a DSS for agriculture enables farmers to make effective decisions for higher yield and lower production costs. Precision agriculture, through the use of remote sensing, geographical information systems, global positioning systems, soil testing, yield monitors and variable rate technology, provide a number of inputs into the DSS. Case studies are presented where the DSS is designed to optimize specific inputs, such as water consumption or pesticide applications by employing precision agriculture through information and communication technology.

A2.L9.1 ELECTRONIC SYSTEMS FOR DATA TRANSFER AND COMMAND

DOI 10.36253/978-88-5518-044-3.30

Sequence ID: 29

A key point in the process of information flow between the different subsystems that take part in the Precision Agriculture management systems is how machinery, software and other electronics systems communicate one each other. Several worldwide standards have been established (such as ISO 11783, known as "ISOBUS") that define precisely the way of transferring information and control commands by the internal electronic communications within farm machinery. Other standards (established or de facto) are also used, such as wireless communication in agriculture.

A2.L9.2 TELEMETRY AND FARM FLEET MANAGEMENT

DOI 10.36253/978-88-5518-044-3.31

Sequence ID: 30

Nowadays farm machinery is incorporating new subsystems for the interchange of data between different mobile equipment and also with the base office. Such systems allow to know in real time basic information about how tasks are being performed in the field (where each tractor and machine is located, surface coverage, dose applied, fuel usage, etc.) but also allow proper synchronization between machines working together (such a combine and a set of supporting trucks). The analysis and management of this information is important for the optimization of field tasks.

A2.L9.3 INTERNET OF THINGS IN AGRICULTURE

DOI 10.36253/978-88-5518-044-3.07

Sequence ID: 31

Agriculture 4.0 & High Tech Farming are strictly related to connectivity between management system and tools (devices and equipment). That is called IoT approach.

The definition of Internet of things is evolving due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems.

In farming system like vineyard and tillage crops, the main applications are related to monitor soil, environment and crops but also to provide prescription maps essential to control automatic operation of devices and equipment.

The systemic system of IoT permits to have augmented knowledge on the overall process that is essential to manage sustainability and product quality. IoT enhances traceability by block chain.

A3.L10.1 CAP LEGISLATION AND SPA

DOI 10.36253/978-88-5518-044-3.33

Sequence ID: 32

Agriculture, a sector with singularities, since long attracted the attention of policy makers for the need of support. In the framework of the EU lead to the formation of the CAP in 1962, aiming to meet various challenges related to the productivity of the agricultural sector, the standard of living of farmers, the stabilization of the markets and the availability of food supplies with reasonable prices. CAP went through many reforms with the initial objectives to be adjusted accordingly. The CAP reform of 2013 for 2014-20, introduced measures for both Pillars I and II, to reinforce the competitiveness of agriculture, to promote sustainable farming and innovation (PA) and support development and employment in rural areas. PA is much more present in the discussions for CAP after 2020.

A3.L10.2 HOW TO START OR BE IN A UNION OR COOPERATIVE?

DOI 10.36253/978-88-5518-044-3.34

Sequence ID: 33

Cooperatives in the EU Member States are subject to the provisions of the Council Regulation 1435/2003. However, cooperative legislation is different among the EU states and most countries have specific rules applicable to cooperatives. There are some steps for setting up a cooperative, which are summarized in: Identification of a common economic goal for potential members, decision about the number of members recruited, their rights and responsibilities, determination of business feasibility, development of a business plan, preparation of legal papers and implementation of the business plan. In many European countries, cooperatives can have a legal status either as a cooperative society with limited or unlimited liability, as an economic interest grouping or as a joint-stock company. Most EU Member have no mandatory provision regarding the minimum capital stock or the minimum number of members for setting up a cooperative.

A3.L10.3 LEGISLATIVE CONSTRAINTS

DOI 10.36253/978-88-5518-044-3.35

Sequence ID: 34

The knowledge of current constraints, information about how to navigate data bases and adaptation to new rules are presented in the current course. Precision agriculture constitutes a data-based management approach that depends on the collection and use of field-specific data. The use of these data triggers the need for an assessment of the suitability of EU law to deal with the legal challenges. At present there is no EU legislation that specifically regulates the ownership of data. The usual practice is data concerning particular farming techniques, as well as personally identifying information (financial data, staff data or other data derived from people's behavior, and sometimes environmental data) to be considered as personal and to be subject to legal restrictions. On the other hand, agronomic data, meteorological data and compliance data are not regarded as personal. Personal farm details are subject to legislation for private life, guaranteed by the Council of Europe Convention on Human Rights (Article 8) and the Charter of Fundamental Rights of the European Union (Article 7). It becomes clear that, personal data are collected for a specific purpose and they are not allowed to be processed in a way that is not relevant with the initial purpose.

The question arises about ownership of data. Farmers legally own the 'Primary data' generated on their farms. However, 'computed data' are considered as being owned by the one who did the computing. Moreover, when data are collected from different farmers, it appears to become the property of the company that aggregates them. Although, there are gaps in the European law and the international standard for creating and sharing farm data, in any case the processing of precision agriculture data is required to follow the new General Data Protection Regulation. That means that only the data for which farmers have given permission could be used and shared. So, they have the right to control the flow of their data to stakeholders. The above implies, also, that only authorized persons should allow access to data and data should be used for as long as is necessary for the relevant analyses to be carried out. Recorded material should be protected during the processing period and automatic deleted after that.

Concerning the use of technologies in precision agriculture of drones, robots and sensors, they collect data that are considered to be confidential farm-related data. Specifically, drones flying over other people's farms and homes can infringe privacy. For this reason, a limited number of people should be allowed to view or access the recorded images or location collected by them. GIS data could provide, also,

information about individuals' actions, so care needed to ensure that rights are not violated.

A3.L10.4 LEGAL CONSTRAINTS ON TECHNOLOGIES

DOI 10.36253/978-88-5518-044-3.36

Sequence ID: 35

The legal constraints of two important technologies for sustainable precision agriculture are presented: unmanned aircraft and artificial intelligence. Unmanned aircraft, or drones, are a rapidly developing technology. By 2035, it is estimated that in the EU, drones will create over 100,000 new jobs and produce more than 10 billion euros per year in revenue. The current situation regarding drone operation is detailed, along with the recommendations of the European Aviation and Space Agency (EASA). Furthermore, the procedure for obtaining a commercial drone permit is briefly described and the situations where such a permit may be required are presented. Finally, the course concludes with the latest EU regulations on ethical use of Artificial Intelligence, presenting the ethics guidelines of the EU for trustworthy AI.

A3.L10.5 STAGE OF DEVELOPMENT, TECHNOLOGY READINESS LEVELS (TRL)

DOI 10.36253/978-88-5518-044-3.37

Sequence ID: 36

Technological revolutions require time, investments, training and analysis to be reliable, profitable and wide spread effective.

For science, modelling knowledge requires years. After the first enthusiastic but critical step of research discovery, deployment requires time and skills: be ready to get your hands dirty, literally. And even more if we are in a chaotic development of a universe of technologies to be set in order.

Each technology has to be assessed in the TRL technological readiness level. Researchers and providers have to respect their own rule in the technology development.

Moreover, technology must to be assessed for the benefit of the technical capacity absorbable by the farm system and the Business model of the farm enterprise.

A3.L10.6 DATA SHARING WHO IS THE OWNER? WHO WILL USE IT?

DOI 10.36253/978-88-5518-044-3.38

Sequence ID: 37

This topic suggests reading and analysing an article about big data and data sharing issues (http://dx.doi.org/10.1016/j.agsy.2017.01.023).

Data Privacy and Use White Paper. (2017). AgGateway.

A3.L10.7 LEGISLATION OF THE EU ON ORGANIC CULTIVATION.

DOI 10.36253/978-88-5518-044-3.39

Sequence ID: 38

This topic will provide an overview of the Legislation on organic cultivation. The EU sets out a number of rules and regulations governing the production, distribution and marketing of organic products in the EU. This is to satisfy consumer demand for trustworthy organic products whilst providing a fair marketplace for producers, distributors and marketers. Organic farming is a fast growing area in European agriculture, which is a direct result of increased consumer interest in organic products. In response to the challenges posed by this rapid expansion and in order to provide an effective legal framework for the industry, the EU has passed new legislation that will come into force on 1 January 2021

A3.L10.8 QUALITY ASSURANCE FOR FOOD

DOI 10.36253/978-88-5518-044-3.40

Sequence ID: 39

Quality became a very important issue in the markets especially in the food sector, as the competitiveness of business involved, depends largely on two factors, the price and the quality of the product. Nowadays quality is the primary factor for every firm that want to succeed in the market and flourish in the long run, an issue realized by all firms worldwide. In line with market requirements and specifically consumers needs, companies, in the industrial, services and food sector, apply total quality management systems (ISO, HACCP). In this context, traceability is among the issues that introduced in the agri-food sector to assure quality, food safety and food security; thus PA role is very important and will contribute more and more to food safety.

A3.L10.9 CLIMATE CHANGE

DOI 10.36253/978-88-5518-044-3.41

Sequence ID: 40

The global temperature rise, of approximately 0.9 degrees Celsius since the late 19th century, due mostly to greenhouse gas emissions, and its future projections of further climate alterations, is commonly known as climate change. Preventing climate change is a key priority of the EU, as well as of other nations. Europe has set specific targets on reducing greenhouse gas emissions in most sectors, including agriculture, and is monitoring Member-States' progress towards these targets. Precision agriculture, through improved fertilizer, soil and water management can significantly reduce climate change greenhouse gas emissions while maintaining, or even increasing, crop yields and reducing production costs, ensuring sustainability of agricultural systems.

A3.L10.10 SOCIAL LEADERSHIP: COMMUNITY MANAGEMENT ONLINE/OFFLINE, DISSEMINATION OF THE MANAGER CONCEPT, RULES FOR PITCHING AND PUBLIC SPEAKING HOW TO APPROACH FARMERS,

DOI 10.36253/978-88-5518-044-3.42

Sequence ID: 41

Agricultural extension is the application of scientific knowledge to agricultural practices through farmer education including rules for pitching and public speaking how to approach farmers. In this course three main objectives will be presented: a) communication with farmers, b) social leadership in rural areas and c) cooperative actions and leading agricultural units. In the first objective will be included the communication theory, model, channels & extension methods. In the second objective will be included the typology of opinion leaders, who to define them and how to take advantage of their leadership. Finally, in the third objective will be included the importance of cooperative actions and units and a study case on how to lead an agricultural association /cooperation.

A3.L10.11 INTRODUCTION, DEFINITION, EXAMPLES (SOCIAL NETWORKS, VALUE CHAINS) - SHARING IS CARING, DEVELOP HUB FOR SPA, FLEXIBLE METHODOLOGIES, HUBS OR CLUSTERS INNOVATION FACILITATORS, SOCIAL ASPECTS OF SPA, SOCIAL NETWORKS, VALUE CHAIN AGREEMENT

DOI 10.36253/978-88-5518-044-3.43

Sequence ID: 42

Recent technological developments and social media have opened up a multitude of opportunities for farmers and agricultural companies to communicate with their customers and marketers. Especially in the EU agri-food sector, smart use of knowledge, research and innovation is the main source of productivity growth. A new digital innovation hub in Precision Agriculture can drive the digital transformation of Europe's agro-food sector, boosting innovation and growth. Moreover, this hub could also play an important role in the exploitation of opinion leadership in agricultural technology and productivity.

A4.L11.1 VISION AND MISSION: BEFORE STARTING A COMPANY

DOI 10.36253/978-88-5518-044-3.44

Sequence ID: 43

The aim of this lesson is to give a definition of mission and vision and to emphasize their importance in designing a new business in agriculture and in PA. Currently all the most famous companies in the world declare, through their website or advertising what their vision and mission are, but even small companies must have their own and agricultural businesses are included. In addition to these concepts, it's also introduced the concept of USP ("unique selling proposition").

The partner farms have been involved in the preparation of this lesson and have been invited to present their vision, mission and USP, so to better explains these concepts to the learners.

A4.L11.2 BUSINESS MODEL CANVAS: AN INTRODUCTION

DOI 10.36253/978-88-5518-044-3.45

Sequence ID: 44

The Business Model Canvas is a strategic tool that uses visual language to create and develop high-value innovative business models. The goal of this lesson is to give a clear and precise definition of BMC and see how this concept can fit into the world of SPA. In this sense, in the previous months the 3 farmers have developed, with the help of external collaborators, their BMC, visually representing the process of creating, distributing and capturing value for their customers. The results are presented as "good practices". The BMC is completed with the presentation of the "external forces framework" . Furthermore, one slide presents the difference between BMC and Business Plan.

A4.L11.3 LEAN MANAGEMENT IN SPA

DOI 10.36253/978-88-5518-044-3.46

Sequence ID: 45

Lean "slim" is a management method that increases efficency of the process analizing sequence, times and infrastructures to create more value with less work. Pillars of Lean production are multiple optimizing actions: 5S (sort, set-up, shine, standardize, sustain), Seven Waste Identification, Value Stream Mapping, Total Productive Mainteinance, error proofing, FastChangeovers, CI Blitz.

Born in Toyota following the evolution of Scientific Method of Management, Taylorism and Total Quality is the actual efficiental method in the productive process. It is a new born method in farming but already used in agro-industry process like winery. It is a partecipative, continuous improvement action that is based on human involvement and structural optimization.

A4.L11.4 LOCAL ECOSYSTEM KEY ACTORS

DOI 10.36253/978-88-5518-044-3.047

Sequence ID: 46

Effective use of technologies is strictly related to direct and ancillary supports. The reliability of technological support system is essential; and territorial development of these skills is fundamental for a trustworthy introduction of innovation.

The performances of the introduced technologies depend on an appropriate support at local and enterprise level: any technology requires providers and services (HD and SW) to be maintained, repaired and set up, which means well-trained consultants and human capital by the appropriate educational system.

The efficiency of the local ecosystem, which supports the introduced technologies, is determined by the skills growth and competences and the Local Ecosystem Readiness Level (LERL), required by the new introducing technology, defines it.

A4.L11.5A IDENTIKIT AND FEATURES OF THE "SUCCESSFUL" ENTREPRENEUR

A4.L11.5a Introduction to entrepreneurial skills in farming

DOI 10.36253/978-88-5518-044-3.48

Sequence ID: 47a

Which are the most important characteristics that an entrepreneur must have? Is it possible to combine being a good entrepreneur and a successful farmer? These are the questions we tried to answer in the lesson. In fact, a good farmer must possess the typical skills of the entrepreneur together with the technical skills related to his specific production area. Certainly the agricultural world is not simple: small farmers live in a risky environment and the "dangers" increase when they produce exclusively for the market.

A4.L11.5B IDENTIKIT AND FEATURES OF THE "SUCCESSFUL" ENTREPRENEUR

A4.L11.5b New skills of sustainable precision agriculture

DOI 10.36253/978-88-5518-044-3.49

Sequence ID: 47b

New technologies have been introduced in the agriculture sector with the growing interest in Precision Agriculture paradigm. Therefore, such innovations forced the farms to enrich their internal competences in order to be able to use the new technologies.

This lesson will provide an overview of which are the new skills required by the workers of the Precision Agriculture sector, highlighting the methodology used to identify such information.

A4.L11.6 FORESIGHT ANALYSIS

DOI 10.36253/978-88-5518-044-3.50

Sequence ID: 48

In the last years, digital technologies burst into the traditional concept of "agriculture" triggering a disruptive change of paradigm. To better understand this technological revolution, this lesson will provide an overview on the results of a technology foresight analysis performed on technical solutions for viticulture and arable crops. After a brief introduction on foresight objectives and techniques, the main insights about the actual most interesting technologies and their directions of development will be shown.

A4.L11.7 BUSINESS PLANS

DOI 10.36253/978-88-5518-044-3.51

Sequence ID: 49

A business plan is a document that describes how to manage a specific activity in a specific period of time. It is actually a study, but also a communication tool, designed to provide information to its potential recipients, whether they are investors and potential partners. Most times, it is used as a tool for strategic decisions or as a tool for the implementation of specific actions. The contents of such a business plan may vary according to the sector of activity; nevertheless it must follow certain standards. Usually business plans are used for the presentation of a company's plans to a bank or another financial institution, for financing. It provides answers to the following three questions: where is the position of the company now, were wants to be and how will manage to be there.

A4.L11.8 ENTREPRENEURSHIP IN THE VALUE CHAIN: CASE STUDY FROM REZOS

DOI 10.36253/978-88-5518-044-3.52

Sequence ID: 50

Hippocrates Farm, of REZOS BRANDS, is an aspiring entrepreneurship agrifood project, started 3 years ago by a team of people of different professional backgrounds but one common goal: to create an open Agro touristic farm, that could be home to excellent natural products with proven positive effect to the human body and mind but also to offer unique experiences for the farm's employees, volunteers and visitors. In this farm, best and novel foods, grown in a natural way, can be offered to humans. Using stringent procedures and sustainable precision practices for organic farming, an opportunity are given to different groups of people to share the full natural experience, reviving a deserted rural area of unique beauty and increasing the comparative advantage of value chain.

A4.L12.1 TOOLKIT FOR AGRIPREUNERS - PRINCIPLES OF FARM MANAGEMENT

DOI 10.36253/978-88-5518-044-3.53

Sequence ID: 51

Farming activities management includes:

1 – Agronomical efficacy in terms of biological care of crops, soil conservation and environmental durability.

1.bis – Today the climate change and food / product quality demand require further tools and practices to mitigate risks due to exceptional weather and pest events.

2 – Operative efficiency in terms of higher capacity of field and appropriate farm machineries, as to say, best logistic of work, perfect geometry and transit conditions.

3 – Technology efficiency of machinery. Appropriate type, size, use, maintenance and repair, structure and procedures of the systems.

4 – Respect of direct and indirect normative constraints.

Sustainability /durability is the mandatory approach that replace extractive behaviour over the last decades.

A4.L12.2 INNOVATION PROCESSES

DOI 10.36253/978-88-5518-044-3.054

Sequence ID: 52

Research and innovation deployment requires skills and time. Innovation is a process that permits to companies and groups to adapt to social, economic and environmental changes. There are different approach to innovation. Some companies prefer to keep innovation place within the company boundaries, (closed innovation), meanwhile others companies have an open innovation approach, so they activate innovation towards a continuous internal and external exchange. This kind of approach see this roots in an open and fluid management of knowledge and know how between all the stakeholders. There are many place for innovation, i.e. the FabLab global network, in which inventors of each sort share ideas, time, space and knowledge.

A4.L12.3 WHAT TO DO WITH DATA?

DOI 10.36253/978-88-5518-044-3.55

Sequence ID: 53

In the use of data, having a centralizing structure is the best strategy for adequate decision making. Current agricultural data is unstructured, fragmented and dispersed. It needs to be organized and prepared for further analysis through different methods such as statistics software, machine learning, integration of fuzzy logic algorithms. The final goal is integrating data on decision making systems.

A4.L12.4 SOFTWARE FOR FARMERS - FMIS

DOI 10.36253/978-88-5518-044-3.56

Sequence ID: 54

Soil and crops, as biosystems, are heterogeneous and can present (or not) high variability. To properly manages then information is required.

In this respect, the latest advances in computing and electronics applied to agricultural have allowed collecting a large amount of farm-related data. However, data can only add value to the farmer if it is transformed into a knowledge base for them. The adoption of a Farm Management Information Systems (FMIS) enables farm-decision makers (farmer, agricultural technician…) better management of the farm and all resources.

A4.L12.5 STUDY CASES (WEB)

DOI 10.36253/978-88-5518-044-3.57

Sequence ID: 55

REZOS BRANDS is a food focused SME, with expertise in superfoods. The company is established in Patras, back in 1983, with main activity the distribution and development of national sales networks of imported and local food & beverages products, operating in the Greek market. Over the years REZOS BRANDS has extended its operations to all activities of the vertical business model: from the farm to the fork, which includes cultivation, harvesting, research, process, packaging, warehouse storing, marketing, distribution. Having own multifunctional farm, the super foods are cultivated and grown up with the principles of sustainable precision farming in order to develop, monitoring & analysing high nutritional value crops. The crops have been processed with novel processing techniques, such as osmotic dehydration.