

SPARKLE e-Learning Platform for Sustainable Precision Agriculture

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Abstract. European farm sector is currently at a crossroad: embracing the future or staying stuck in old practices. The future is represented by Precision Agriculture (PA), which is a new mind-set approach and a new network of different technologies. For this reason, the farmer of the future, the so-called “agripreneur 4.0”, needs a mix of competencies such as agricultural, entrepreneurial, digital and environmental skills. One of the main goals of the SPARKLE project is creating a new e-Learning course for agricultural students, in order to enhance their business-oriented skills and entrepreneurial activity in a smart environment. In this paper the SPARKLE e-Learning Platform for Sustainable Precision Agriculture is presented.

Keywords: e-Learning; precision agriculture; entrepreneurship.

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1 Introduction

The European farm sector is currently at a crossroad: embracing the future or staying stuck in old practices. The future is represented by the so-called Precision Agriculture (PA), that is defined as “an integrated information and production-based farming system that is designed to increase long term, site-specific and whole-farm production efficiency, productivity and profitability while minimizing unintended impacts on wildlife and the environment” (European Parliament, 2016). PA is not a technology, but an approach to manage a crop that requires and a network of different technologies (digitalization, metadata, Internet of Things, IT, etc.) to sense, decide and act precisely that can be adopted in agriculture (European Parliament, 2016).

The future of agriculture is the so-called “agripreneurs 4.0”: an entrepreneur who works in agriculture and adopts in its business PA technologies (SPARKLE, 2019). Therefore, this means that the *agripreneur* needs a mix of competencies a full set of entrepreneurial skills and, at the same time, a complete set of PA related knowledge, along with agricultural skills. Taking a look at the agricultural university education, it is clear that the third set of competencies are available in all the institutions, while the other are, in many cases, missing. The SPARKLE project underlines the need to improve university education in the agricultural sector to train students on the relevant skills for becoming *agripreneurs 4.0* which is currently barely absent.

In this paper we present the SPARKLE e-Learning Platform for Sustainable Precision Agriculture (SPA). SPARKLE e-Learning Platform is the primary outcome of the SPARKLE project and it aims to implement an educational package for students and *agripreneurs* to help them in growing specific skills on entrepreneurship and sustainable precision agriculture.

2 SPARKLE Project

For being able to offer the students a new training program, it is fundamental for the Universities to establish more direct contacts with farmers, researchers and students, for better understanding the level of knowledge on PA and identifying the entrepreneurial needs for starting new Sustainable Precision Agriculture (SPA) businesses.

SPARKLE, an acronym standing for Sustainable Precision Agriculture: Research and Knowledge for Learning how to be an agri-Entrepreneur, is a Knowledge Alliance project, co-financed under the ERASMUS+ project. One of the aims of SPARKLE is to bring together research, SPA farmers, and students to develop and fill the gap in the educational offer to prepare farmers and agriculture’s business managers of the future.

The consortium is composed of 3 different categories of partners (SPARKLE, 2018):

- Universities, through their Agriculture Faculties (University of Florence (IT), Universidad Politecnica de Madrid (ES), Aristotle University of Thessaloniki (GR), Universidade de Evora (PT))
- Companies providing advanced services to companies/farms (CSIC – research center on automation and robotics (SP); AgroSAP (Precision Agriculture consultancy

(SP); ErreQuadro – technology foresight (IT); Valuedo – entrepreneurial education (IT))

- Farms adopting PA technologies (Quinta da Cholda (PT) – arable crops sector; Rezos Brands (GR) – fruit growing; Mazzei 1435 (IT) – viticulture).

3 SPARKLE e-Learning Platform

One of the main aims of the SPARKLE project is to develop and assemble the e-learning supporting materials for the SPARKLE e-Learning Platform (general guidelines for attendees, materials and quizzes/tests/etc.). For this reason, a set of technical criteria were suggested for the development of the e-learning course. The SPARKLE project e-learning course is an asynchronous online course (courses where students are not required to participate in sessions at the same time as the instructor) using a learning management system. The e-learning courses are designed for large numbers of participants, offered for free and without any entry qualifications. The course is being provided through MOODLE Platform and for a specific number of participants, mainly students and precision agriculture users, lead to an ECTS recognized certificate. Moodle is an open-source Learning Management System (MOODLE, 2020). The advantages of Moodle are: 1) provides detailed guides on how to set up an e-Learning Platform, 2) provides tips on how to create online training courses and teaching programs and 3) it has a large community of users who interact on various topics. Finally, it has no charge fees and supports the use of mobile phones.



Fig. 1. The Home Page of SPARKLE E-Learning Platform.

The final prototype of the course is an e-Learning course with the initial architecture (four areas and 14 topics) hosted on <https://sparkle-project.eu/moodle> web address. The course provides to students: video material, slides, textual material and some case study for a minimum of 13 hours of e-learning. This part is assessed through online tests. After this self-directed online learning, there are 8 hours of face to face lessons dedicate to strengthen business and management skills. To conclude the educational

package, the final 4 hours of the course are devoted to case study and practical activities on the field. The course is divided into 4 areas and 12 lessons (Table 1). The target group of the course are university students, agri-entrepreneurs and academics.

The course intends to present a general overview of the state of the art of Sustainable Precision Agriculture and related technology and teaching how to build an entrepreneurial mindset. The students will explore a range of precision agriculture technologies with specific insights on geomatics, sensors, data mining, machine learning, robotics etc. for farming and innovations while taking into account the environmental, social and business issues. At the end of the course, the students will be invited to put into practice the knowledge and skills developed.

Table 1. Areas and Lesson of SPARKLE e-Learning Course.

Areas	Lesson
SPA Overview	1. Introduction To SPA
	2. Variables and Systems
Technology	3. Positioning Systems
	4. Proximal Sensing
	5. Remote Sensing
	6. Variable Rate Technology
	7. Robotics
	8. Data Analysis
	9. Communications
Social & Economic Aspects	10. Policy & Management
Entrepreneurship in Farming	11. Entrepreneurship In SPA
	12. Toolkit for Agripreneurs 4.0

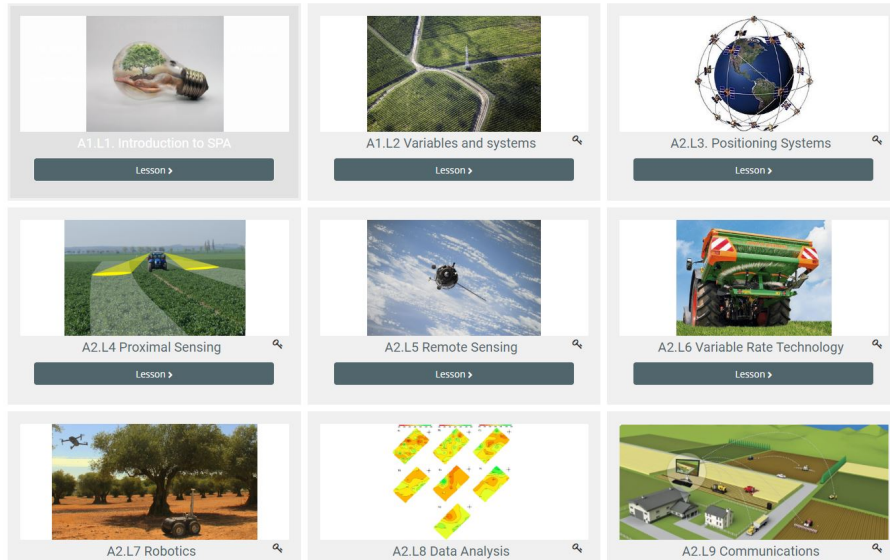
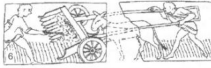


Fig. 2. The Page of the SPARKLE Course Lessons.

Inside the Lessons, there were developed 56 contents that are available at a table of lessons and tasks.

A1.L1.1 Agriculture historical steps towards Sustainable Precision Agriculture

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 known as spatially-variable, or site specific crop production".

The concept of sustainable development was introduced in 1987 in the Brundtland 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 Agricultural Policies toward 2020: competitiveness; food safety and quality; farmers' wellness and proper income; environmental respect; new jobs opportunities for farmers' communities

- A1.L1.1 Agriculture historical steps towards Sustainable Precision Agriculture
- Video 1
- Video 2
- Contributors
- Quiz: A1.L1.1 Agriculture historical steps towards Sustainable Precision Agriculture.
 - 272 of 334 Attempted
- Evaluation of the Topic

Fig. 3. A typical structure of a task inside a Lesson of SPARKLE course.

4 Conclusions

In this project, partners share the main feature of knowledge alliance as innovation in higher education and innovation in enterprises. In fact, the e-learning platform will continue to spread the knowledge about the SPA also after the end of the project.

The creation of such a training course, answers to a specific need that is actually unsolved. All project companies are interested in strengthening their relationship with the agricultural sector and gathering new information, advanced studies and creating more reliable networks with both Universities and companies. Some of them already work with farmers; others do not: for the latter the objective is entering in a very interesting field, bringing their advanced services to fill the entrepreneurial and PA knowledge training gaps. The three PA companies already adopting PA technologies would like to enlarge their network and contributing to the using of innovative technologies by other farms, so to create a new group of innovative *agripreneurs*.

SPARKLE will contribute to provide a new approach to teaching and learning entrepreneurship, at the formal and non-formal level. The project activities stimulate entrepreneurship and entrepreneurial skills of higher education staff involved in the project, making them educators of sustainable precision agriculture and agribusiness. Moreover, SPARKLE outcomes will be easy to multiply in other Universities and companies after the project ends.

First, at little or no cost starting from 2020 onwards, partner institutions during their regular professional activities will easily encourage new individuals from the identified target groups to successfully attend and complete the SPARKLE e-learning courses, since the educational packages will be already tested and in an accessible e-learning format. This multiplication scheme allows the partners to foresee attainable gains.

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