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Toward development of policies and initiatives for improving digital skills in sustainable agriculture on Europe – lessons learnt from AgriSmart

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ACRONYMS AND DEFINITIONS

Definitions	
CAP	Common Agricultural Policy
CEDEFOP	European Centre for the Development of Vocational Training
ECVET	European Credit system for Vocational Education and Training
EQF	European Qualification Framework
EU	European Union
VET	Vocational Education and Training

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Table of Content

1. AgriSmart motivations and goals 5
2. Lessons learnt from AgriSmart 7
On the demand for training on digital agriculture and sustainable farming 8
On the development and evaluation of training material and open resources 9
On the establishment of enabling conditions for supporting digital agriculture skills development 11
3. Conclusions 12
References 13

1. AgriSmart motivations and goals

The agricultural sector, one of European Union's (EU) big employers directly giving work to nearly 8.7 million people worked in agriculture in 2020 according to EUROSTAT, is inherently linked with climate change, since agriculture is both affected and at the same time contributes to it. Recognising this link, the EU has prioritised the promotion of "digital agriculture", also referred to as "climate-smart" agriculture, and has signed up to relevant international commitments, especially those concerning climate change and sustainable development. These commitments are reflected in the Common Agricultural Policy (CAP), with "smart farming" being a central component of transitioning toward more sustainable agricultural practices (EC, 2022).

Accordingly, digital technologies are central for the development of a smarter, resource-efficient, and thus more competitive agricultural sector. In fact, farmers' digital skills are identified by the EU and the Food and Agriculture Organization of the United Nations (FAO) as a prerequisite for a digital agricultural transformation. Nonetheless, the digital divide between urban and rural (namely where farmers reside) areas in Europe still persists, notwithstanding EU's efforts and various activities to improve rural populations' digital skills.

In terms of initial and continuing education and training, the vast majority of farmers in the EU relies solely on practical experience, with only one in ten having full agricultural training, and two in ten having some basic training. Thus, the effort to develop the digital skills of workers and increase the sustainability of the sector must consider that agriculture has a particularly strong practical experience component; Work-Based Learning (WBL) is vital for achieving this objective.

Yet, existing training offerings at post-secondary and Vocational Education and Training (VET) level place little to no emphasis on these dimensions, as demonstrated by current curricula offered by VET providers in most EU countries. Therefore, there is an increasing need to better

align WBL with existing and emerging workplace requirements and realities. Especially as it regards environmentally sustainable and digital practices and applications. Moreover, WBL schemes need to update their offerings and skills portfolio to better address learners' climate-smart and digital skill training needs, conjointly developing training opportunities for upskilling existing workers on the basis of such competences.

AgriSmart, an Erasmus+ KA202 project conducted by a partnership of six EU countries, has been motivated by these premises. AgriSmart aims at adapting VET and WBL provision to existing and emerging occupational needs in the agricultural sector, with the overarching goal of strengthening the climate-smart and digital skills of farmers, as well as to support growing awareness and stronger competences on sustainable agricultural management practices that can, and need to, be adopted in line with the EU CAP (SAGRI, 2017). The specific objectives of AgriSmart are to:

- Design a course curriculum on climate-smart and digital practices, addressing current and future occupational needs.
- Introduce various training delivery methods and innovative open access pedagogical resources, tailored to sectoral characteristics, to support VET and WBL provision.
- Increase the capacities and enhance cooperation between public and sectoral stakeholders to promote the integration of climate smart and digital skills development in training offerings and regional policies, thus reaching out to agricultural communities.

The produced open material, all available on the AgriSmart website, has the ambition to be a valuable source of knowledge and practical tools for a broad range of stakeholders, including agricultural training institutions, mentors offering WBL opportunities, apprentices and workers to be upskilled, associations and sector representatives, VET authorities & career guidance bodies and local authorities (i.e., municipalities), among others. The material includes:

- a modular curriculum for VET provision and Open Educational Resources (OERs);
- a Vocational Open Online Courses (VOOC) comprising the AgriSmart course in its online

form;

- a Mentor's toolkit for the integration of the AgriSmart learning outcomes in agriculture WBL;
- a set of resources for the promotion and implementation of training on climate-smart and digital skills in agricultural communities.

The aim of this position paper is to summarize the most important lessons from AgriSmart that are relevant to support public and sectoral stakeholders at a local, national and regional level implementing actions that aim to improve climate smart and sustainable agriculture skills. The paper is addressed to bodies responsible for agriculture development, policies and measures, including ministries as well as regional and local actors.

2. Lessons learnt from AgriSmart

The major drought that severely affected a significant part of Europe in 2022 has exposed the vulnerability of EU agriculture to climate change. Accordingly, emphasizing the importance of rapidly implementing technological and practical innovations for more efficient use of agricultural inputs and for mitigating agriculture contributions to greenhouse gas emissions.

A wider adoption of digital technologies and climate-smart agricultural management practices is expected to increase the long-term productivity and yield of crops, through the conservation and more efficient use of soil, water, and genetic capital, as well as to increase the resilience of the agricultural sector to climate extremes. However, the incubation of agricultural innovations at all levels (from single farmers to industry and public institutions) requires dedicated investments of awareness creation and capacity building; that need to be co-developed with stakeholders with a bottom-up approach based on the actual gaps and requirements (i.e., their demand). AgriSmart can be considered a first step in this direction. In the next sections of this chapter, the main lessons gathered from AgriSmart with relevant implications for future policy design are presented.

On the demand for training on digital agriculture and sustainable farming

AgriSmart conducted a desk review and participatory investigation with over 80 stakeholders across the six project countries to determine the most valued and needed digital skills required in agriculture, and to highlight existing skills imbalances and experiences from employers (farmers) when it comes to the implementation of sustainable agricultural work.

From this survey, several insights were gathered that helped designing the AgriSmart curriculum. Key lessons are here summarized:

- while most respondents have indicated at least some level of familiarity with digital technologies, **there is a strong heterogeneity across the different EU countries** in the level of familiarity and even more on the actual direct use of these technologies for sustainable farming;
- the **stronger demand for training is on basic skills in digital data and technologies** (e.g., smartphone applications, GPS, web platforms and sensor control operations), and on sustainable agricultural management practices and associated EU policies. More advanced technological skills (precision agriculture tools, GIS, remote sensing, Decision Support Systems, etc.) were also indicated as important but with more heterogeneity across countries and stakeholders;
- the VET offering and the associated job opportunities in EU is vast, indicating a high level of investment in this domain and a strong demand. Still, here significant heterogeneity is again observed across the project countries. Moreover, trainings generally focus either on digital skills and technologies or on sustainable farming, while the integration of the two knowledge domains is less common. In addition, **the VET offering rarely integrates a WBL component**.

On the development and evaluation of training material and open resources

Based on the findings of the desk review and survey, the AgriSmart curriculum and associated training material have been developed in compliance with the definitions for the trainees' achievements (EQF – European Qualifications Framework definitions) (EC, 2017) following EU guidelines (CEDEFOP, 2017). The curriculum is modular and includes 6 Learning Units, identified based on the needs expressed by the stakeholders' community (Table 1).

Table 1. The Learning Units of the AgriSmart curriculum

AgriSmart Learning Units	EQF level
Learning unit 1: Common Agricultural Policy	**5**
Learning unit 2: Sustainable Agriculture	**5**
Learning unit 3: Sustainable Water Use Management	**5**
Learning unit 4: Sustainable Weed & Pest Management	**5**
Learning unit 5: Agriculture 4.0	**5**
Learning unit 6: Data for sustainable production	**5**

The curriculum does not aim to cover comprehensively all the topics that are related to digital skills and sustainable farming. Instead, it provides a modular educational framework on a set of priority areas that can be further expanded, adapted and customized for the specific purpose of the training to be offered. This also reflects the different perspectives and approaches encountered across the countries.

The curriculum is integrated with a set of Open Educational Resources, including a Learners E-Book to support trainers and trainees in the use of the material. Furthermore, the curriculum has been integrated in a VOOC. The 160 hours course can be followed by individual users (self-

learners), but is designed specifically to be adopted by trainers and teachers with their students. It contains 64 lessons and is available in 7 languages: English and all 6 languages of the partners of the consortium. Finally, a Mentor Toolkit has been developed to provide support material for mentors involved in Work Based Training activities.

All the AgriSmart material has been reviewed by the partnership with internal Quality Assurance mechanisms, and discussed with key informants, sectorial experts and stakeholders with a variety of expertise. Important messages that arose from this process can be summarized as follows:

- The development of a common learning framework across multiple EU countries is certainly valuable and provide critical lessons for supporting future efforts for improving skills on digital agriculture and sustainable farming. However, **each country has different approaches to delivery VET and WBL (CEDEFOP, 2022), therefore the material needs to be customizable and developed in a variety of formats** to be further integrated in local training systems.
- There is a strong difference in learning needs and skills among farmers coming from different agricultural production systems also within the same country. These differences need to be factored-in when customizing the training material in order to reconnect the learning experience with practice**. Adaptive teaching/learning approaches would be important to deliver the material to the local context.**
- Farmers need user-friendly and accessible functional tools, software and applications for keeping up-to-date daily farm records, and these **tools could be combined with e-learning and m-learning applications to support a continuous learning process on efficient use of digital resources and sustainable management practices**.

On the establishment of enabling conditions for supporting digital agriculture skills development

AgriSmart has been conducted from the beginning with support from institutions aimed at connecting practice, education and policies such as the Fondazione Lombardia per l'Ambiente (Italy) and the Competence Center of organic farming in Lower Saxony (Germany). This network has expanded over the project duration, resulting in the organization of multi-stakeholders workshops across the 6 countries with about 300 participants; with the goal of disseminating the AgriSmart open material, facilitating its adoption by public and private organizations and receiving feedbacks on the curriculum and learning support material.

Here are listed the main take-home messages emerged from these interactions:

- The urgent demand for digital skilled labour may be caused by a lack of specific digital educators able to create a solid and EU focused vision about the digital agricultural sector. **Farmers are resistant to the introduction of new tools and technologies due to lack of clearness and accuracy; the creation or divulgation of a basic knowledge of the digital practices is necessary to effectively spread technological and agricultural knowledge.**
- To reconnect agricultural management practices, scientific innovation and sustainability targets, **it is important to keep in careful consideration the cost/benefit for companies and farmers of the introduction of digital innovation and more sustainable agricultural practices.** Without clarity and incentive mechanisms, the transition toward digital and sustainable agriculture would remain slow and limited.
- Changes are needed in the legislation, to retrain workers and promote marketable skills. **Whilst companies operating in agricultural development try to push green and sustainable solutions, a legislative effort is required to clarify the costs and benefits for the farmer, and quantify the motivations for new agricultural technologies**. The

strategy of the EU Department "employment, social affairs & inclusion" is a first communitarian step in this direction.

- **It would be fundamental to support digital agriculture skills and competences in a lifelong learning approach, aimed to increasing the basic digital skills over time and linking them to evolving sustainable agriculture practices and policies.** This is a fundamental gap that would need to be integrated in future efforts to design curricula and training material.

3. Conclusions

In the context of the European Year of Skills, the EU Commission has recently adopted two proposals for a Council Recommendation aimed at supporting Member States and the education and training sector in providing high-quality, inclusive and accessible digital education and training to develop the digital skills of European citizens. The first proposal focuses on creating the enabling conditions for successful digital education and training through appropriate governance structures and framework of investments and bottom-up approaches in training design involving multiple stakeholders. The second proposal focuses on improving the provision of digital education and training at all levels, including the "hard-to-reach" groups.

The approach adopted by AgriSmart is fully aligned with these proposals and the AgriSmart results and lessons learnt could support their future implementation in the agricultural domain. We noticed a significant fragmentation in the EU on the approaches to delivering education and training in the agricultural sector, promoting the necessity for coordinated governance and legal structures to create essential pre-conditions to enable effective training and education of farmers on basic digital skills in agriculture. We also recommend the importance of technical and practical innovation in the provision of training (including digital learning), and the need of more adaptative and lifelong learning approaches, linking training with the local agricultural context and practices through WBL.

Overall, the implementation of these proposals would certainly have a strong impact on transforming the agricultural sector, starting from digital education and training on fundamental digital skills. However, we also point out that filling the gap of digital skills for rural farmers would be a necessary but not a sufficient step for shifting the agricultural sector toward more resilient and sustainable pathways. In line with the EU CAP, digital innovation needs to be closely linked with cost-effective innovation in agricultural practices and incentive mechanism for their effective adoption.

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