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Addressing the current and Future skIll needs for sustainability, digitalization and the bio-Economy in agricuLture: European skills agenDa and Strategy

Survey report WP2.3: principles of a European strategy on agri-food-forestry skills	
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Author(s)	Jacques Trienekens
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CONTENT

1. Introduction

The aim of the FIELDS project is to contribute to skill enhancement of workers in the agriculture, food industry and forestry sectors, to be able to make full use of the opportunities and comply with requirements of the "Twin" Green and Digital transition. The FIELDS project focuses on the domains Digitalization, Sustainability, Bio-Economy and Management & Entrepreneurship. Skills include ''hard''/ measurable and technology-based skills as well as ''soft'' / transversal skills.[1]

One of the tasks in the FIELDS project (task 3.2) is the development of a European Strategy for skills enhancement in the agriculture, food industry and forestry sectors. Aim is on the one hand to set up a strategy for the further execution of the fields project (in the years 2022-2023) and on the other hand to link up with the recently Established Agri-food Pact for Skills, spearheaded by the European association for the food and drink industry, FoodDrinkEurope, and the European association of cooperatives and farmers, Copa-Cogeca. In the outline of the Pact as proposed on the 18th of October, 2021 the Agri-Food Pact for Skills partnership state: "The aim is to set a joint strategy to design and implement a sectorial upskilling and reskilling framework, maximising competitiveness of all the actors involved, job retention and job attractiveness for the agri-food system within the Pact for Skills" (Agri-food Pact for Skills, 2021).

This document is an intermediate step towards the final strategy document/deliverable that will be finalised in month 45 (September 2023) of the FIELDS project. The objective of this step is to formulate key principles for the development of a European agri-food-forestry skills strategy, by collecting and analysing ideas and opinions of the partners in the FIELDS project. Therefore, a questionnaire survey has been performed. It has taken the job profiles and skill needs as defined in FIELDS tasks 2.1 and 2.2 as a starting point and includes the following topics:

- Harmonization challenges in the European agri-food and forestry skills ecosystem
- Monitoring of the European agri-food and forestry skills ecosystem
- Key performance Indicators (KPIs) for assessment of the partnership (for agri-food and forestry skills) and assessment of training programs and modules
- Partnership and governance of the European agri-food and forestry skills ecosystem
- Analysis of skill needs in the selected job profiles to investigate clustering possibilities for training purposes, including attention to management/entrepreneurship and soft skills, the position of practical training and the position of online training.
- Target groups, including attention to gender issues and underprivileged groups
- Use of resources

The selection of these topics is based on EU policy documents and reports of EU level organizations involved in the analysis of skill needs and/or the design of training. This information was complemented by discussions with FIELDS project partners. The selection of questionnaire topics is further documented in annex 1.

In this report 11 principles of a EU strategy on agri-food and forestry skills are proposed as well as 3 action points. These action points are:

[1] *The FIELDS project is consistent with main EU policies in the fields of sustainable and circular production. The European Green Deal, announced by the European Commission in December 2019, followed up on the UN Sustainable Development Goals (SDGs) and COP21 (the UN climate change conference of 2015). It commits the EU to become climate-neutral by 2050 whilst promising to help companies to become world leaders in clean products and green technologies. It aims to boost the efficient use of resources by moving to a clean, circular economy while restoring biodiversity and cutting pollution. The Green Deal encompasses a New Circular Economy Action Plan, a Sustainable Europe Investment Plan, a Biodiversity Strategy for 2030 and, a new Farm to Fork strategy on sustainable food throughout the value chain (EU-Green Deal, 2021).*

- to discuss and design, in collaboration with key stakeholders, the outline of a European agri-food skills ecosystem monitoring infrastructure
- to discuss and design, in collaboration with key stakeholders, the outline of a governance structure for a European agri-food skills ecosystem observatory
- to define, in collaboration with key stakeholders, Key Performance Indicators (KPIs) for the agri-food and forestry skills ecosystem

2. Method

A questionnaire (annex 2) on key topics was distributed among the organisations that partner in FIELDS (see annex 3). Fields partners were asked to focus in their answers on one domain: agriculture, food industry, forestry. The questionnaire was sent out in the first week of October 2021, responses were received until mid-November 2021. 25 out of 30 FIELDS partners sent in their response: 14 focusing on the agriculture sector, 7 focusing on the food industry and 4 focusing on the forestry sector.

The questionnaire was semi-structured. Respondents had to apply questions to 3 job profiles for the agriculture sector, to 3 job profiles for the food industry sector, or to 1 job profile for the forestry sector.

The results were qualitatively analysed. Answers were first grouped (in excel files) according to sector, job profile and key topic in the questionnaire. Subsequently further analysis was based on the key topics, sometimes rearranged or grouped if necessary. For example, the answers on online training were included in the analysis of learning content and structure. In the final analysis results from different sectors and job profiles were combined, as for a number of topics no differences between sectors and/or job profiles had been identified. When necessary, however, differences between sectors and/or job profiles were articulated.

3. Results: key principles for the formulation of a European skills strategy for the agriculture, food industry and forestry sectors.

3.1 Harmonisation of VET systems

Challenges in the harmonisation of VET systems in the EU as reported by respondents are:

<u>VET system level challenges</u>

- Differences in VET systems between countries and regions, including different regulatory systems and different funding systems (for example, Germany has a unique dual system structure of VET: combination of theoretical training in schools with practical training in companies; in the Netherlands industry/companies are involved in setting the criteria for VET courses according to a specific qualification structure. Within this framework industry also provides internship opportunities (SBB – organisation for collaboration between vocational education and industry).
- The European Qualification Framework (EQF) and National Qualifications frameworks (NQF) operate at different levels. For example, the EQF framework has 8 levels while the NQF framework in Ireland has 10 levels. Moreover, not all countries have a NQF with learning outcomes for each qualification
- There is no integral system of degree recognition in the EU yet
- Many stakeholders work in isolation and don't show much interest in harmonization
- The EU Skills Agenda doesn't have an implementation plan (yet), with specified roles for different stakeholders.

<u>VET program level challenges</u>

- Many VET programs are usually adapted to regional and local industries. Also, job profiles may vary according to national road maps. Indeed, specific regional needs require specific solutions, i.e. not everything can be harmonised. This makes it challenging to target common goals. Though, basic skill needs/training may be easier to harmonize

- A lack of best practices exchanges between educational systems
- Differences in job profiles and skill needs between countries, due to sector/industry differences, differences in business structure and company/farm size, differences in climate conditions
- Different levels of knowledge and skills across countries and different competence levels of trainers across countries.

From the respondent answers the following principle could be derived:

***Principle 1**: support harmonization of the agri-food and forestry skills ecosystem*

- A common European catalogue and repository of training courses/programs together with a system of micro credentials should be designed, linked to national catalogues to define specific needs.

- This should be aligned with a harmonized certification system for VET courses/programs and VET providers. Agreement between public and private parties on the catalogue and certification system is essential, to co-create the new skills ecosystem and to unlock public and private funds.

3.2 Monitoring of the skills eco-system

Typical challenges that were mentioned for a European skills monitoring system are:

- The harmonisation of national education systems
- The identification of a common methodology for skill needs assessment and monitoring
- The inclusion of transversal/soft skills (transversal skills are not really evaluated in most countries)
- The commitment of member states and stakeholders to provide feedback
- Funding, design and maintenance of the infrastructure.

Many respondents are not aware of existing monitoring systems. In this regard several respondents consider identification of skill needs in the first place something that is done by companies in collaboration with education/training organisations.

However, many initiatives to monitor the skills ecosystem already exist, although often in scattered form. Examples are:

At international level:

- EU-Eurostat, education and training statistics cover the following topics (https://ec.europa.eu/eurostat):
  - Participation in education and training (including adult learning);
  - Learning mobility;
  - Education personnel;
  - Education finance;
  - Education and training outcomes;
  - Language learning and self-reported language skills.
- EU Education and Training monitor (uses, among other things, Eurostat data) (https://ec.europa.eu/education/policy/strategic-framework/et-monitor_en)
- Eurydice provides information on education systems and policies in EU countries (https://eacea.ec.europa.eu/national-policies/eurydice/)
- CEDEFOP – skills intelligence - includes data from the European skills and jobs survey, CEDEFOP skills forecast data, data on skills in online job advertisements. https://www.cedefop.europa.eu/en/tools/skills-intelligence (annex 5)
- The Erasmus+ projects ASKFOOD has designed an observatory to monitor and analyse education and training challenges and needs in the food system, as well as to deliver the latest news and innovation trends in relation to education and training in the food and food-related sectors from a Lifelong Learning perspective. https://www.askfood-observatory.net/

- OECD keeps track of data on Outcomes of educational institutions (education Impact), Participation and progress (access to education), Investment in education (financial resources), Teachers and school organisations (learning environment). https://www.oecd.org/education
- Think tanks (e.g. supported by Mc Kinsey, on the future of education) (https://www.mckinsey.com/~/media/mckinsey/industries/public%20and%20social%20sector/our%20insights/closing%20the%20future%20skills%20gap/wgs-future-skills-jan-28-2019.pdf)

National initiatives (examples from respondents)

- Proagri (Finland) maintains a process of continuous competence development (www.proagria.fi)
- NVF (Czech republic) has developed a function which supports analyses of trends and policies in employment, education and training; supports the development strategy of human resources at national and regional level; and provides training http://en.nvf.cz/narodni-observator
- The Catalan talent observatory (Spain) observes labour markets, job offers and skill requirements in Catalonia https://talent.aqu.cat/visual/index/index.html
- The Finish Institute of Technology (https://fitech.io/en/) has started to use an AI based analysis tool on future skill needs; however, the outcomes cannot yet be interpreted
- and many other national initiatives (government, employment and business organisations, education institutes)

Many respondents find that a self-sustaining supranational institute/governance mechanisms should be responsible for monitoring the European skills ecosystem, linking up with a network of education and training actors, SMEs, innovation actors, etc. Respondents came up with different ideas on the organisation to be responsible for design and maintenance of the European monitoring system:

- DG EAC, DG EMPL, DG GROW in collaboration with national (education/training) ministries and education and training institutes
- EU institutions and sector organizations involved in job market, skills and training needs analysis, including EIT, ESCO, CEDEFOP, EQAVET, EQAS, FDE, Copa-Cogeca, ...
- Agri-food Pact for Skills
- The Erasmus+ program, supported by stakeholders, and including, for example, a bi-annual European agri-food skills conference
- A supra-national organization is **not** needed; actual needs are best monitored locally. Regional authorities and public employment agencies should have a key role in monitoring.

A platform of digital services supporting diagnosis and monitoring of the skills ecosystem is considered essential by several of the respondents. The platform should include a database of current and future skill needs, supported by big data analysis tools. The system/platform to be designed should be smart, user friendly, upgradeable, interoperable, and financially sustainable. Assessment of KPIs should take place on a regular basis. Quantitative skill needs forecasting techniques should support the process. Updating should be supported by major input from training centres (student/trainee surveys) and companies (employer surveys), while regional and sectoral authorities should cooperate in the monitoring.

From the findings the following principle can be formulated:

Principle 2: *a supra-national institute/organisation should be responsible for design and maintenance of a monitoring infrastructure for skills. The system should be smart, user friendly, upgradeable and interoperable. The many examples of monitoring systems working on national and multi-national level should be the starting point of the development of a European skill monitoring infrastructure.*

3.3 Key Performance Indicators

The survey respondents added Key Performance Indicators (KPIs) to the inventory provided in the questionnaire, for assessment of the skills partnership and for assessment of training modules and courses, see tables 1 and 2.

Table 1: Assessment of the partnership:

- Stakeholders actively involved (who provide quality upskilling opportunities, in education/training; who play a role in sectoral drivers of change
- Coverage of countries and regions, (sub-)sectors
- Visibility and awareness
- Public opinion, consumer opinion
- Definition and maintenance of a strategic agenda
- Honest and clear communication to different target groups
- Best practice dissemination
- Willingness of partners to share information/knowledge
- Impact on training programs and interest for the training programs (number of interested participants)
- Employees actively interested in participating in Life-Long Learning
- Yearly growth rate of new courses
- Raised level of final degrees of food employees
- Link with our scenarios, see whether profiles support desirable outcomes

Table 2: Assessment of training modules and courses:

- Number of students, companies in the course
- Number or % of participants from underrepresented groups
- Achievement of learning goals (e.g. increased level of knowledge - tests before and after taking the module by trainees)
- Student evaluation/satisfaction of training content and method
- Number of certificates achieved
- Flexibility of programs (hours, ECTS, online/face-to-face, ...)
- Renewal of programs (new elements added year to year)
- Resources per module (human resources, financial, technology...)
- Weight of virtual, augmented and connected reality in the training modules, % of audio visual learning vs class learning
- Use of educational material and acquired skills in the workplace
- Learning outcomes in practice (logbooks, blogs, ...)
- Employment status of trainees after graduation, incl. job promotions
- Placement rate for unemployed learners
- Trainees and employer job impact evaluation (better execution of tasks, increased salary, new employment,….)
- Rate of young people/workers recruited in agri-food sector
- Employer satisfaction

The following principle was underlined by many respondents:

Principle 3: *KPIs are needed for ongoing assessment of the skill partnerships (Pact for Skills) and for assessment of training modules/courses. KPIs can be used for monitoring progress and outcomes and to take decisions on the way to go forward. A system of KPIs should be limited in complexity, and be transparent and user friendly.*

3.4 Partnership and governance

The questionnaire included a list with potential partners for the agri-food Pact for Skills as well as forestry sector players. A number of potential partners for the skills alliance were added by the respondents, resulting in a long list of stakeholders. We distinguished 5 categories of stakeholders, in line with FIELDS deliverable 1.3. Table 3 shows potential participants in an agri-food/forestry skills partnership.

Table 3: Potential partners in the agri-food/forestry skills partnership

• VET providers: VET schools, VET providers, HEI, other educational providers, private education providers • Policy makers: EP, DG EAC, DG EMPL, DG AGRI, DG GROW, DG ENVI, DG SANTE, national and European Food Safety authorities, Ministries of Education regional governments, regulatory bodies • Decision makers: farmers, coops, foresters, industries, SMEs, start-ups, agricultural cooperatives, agri-processors, agri-supply chain businesses, input providing companies, Croplife, Fertilizers Europe, CEMA, CEJA, universities, students • Advocacy: representative bodies (e.g. Copa-Cogeca, FoodDrinkEurope, CEPI, ETPs, Pact for Skills), advisers, coops, unions, chamber of agriculture, student societies, industry federations, NFTPs, national entrepreneurial federations, consumers, chambers of commerce and citizenship organizations/NGOs, civil society organizations in education and training, organizations that advocate for sustainable land-use, regional and sectoral employment agencies • European level VET support organizations: EfVET, LLLP, Cedefop, EIP-agri, European federation of food science and technology (EFFoST), safe and sustainable food system partnership (SSFS), ASIIN, EQAS, EQAVET

On the governance structure for a future agri-food and a forestry skills partnership, only few respondents presented ideas. Respondent Confagricoltura proposes a ‘’light’’ structure for an observatory like organization on agri-food job challenges, including functions such as:

- a monitoring system
- analyzing the impact of different measures, tools, policies
- communicating bi-monthly results and initiatives
- suggesting best practices and solutions for new needs
- advancing medium and long-term EU and national scenarios
- facilitating arbitrages on conflicts and consensus policies
- listening frequently to main stakeholders
- consulting yearly the scientific communities and VET providers

Overall, respondents find that governance and decision making should be performed by a council of representatives from all sectors, including stakeholders mentioned and funding bodies, spearheaded by FoodDrinkEurope and Copa-Cogeca. A secretariat and fund-raising function should be included in the organization. Further, the governance structure should include a set-up of working groups and workshops. A culture of experimentation should be stimulated.

Respondents Confagricoltura and University of Turin provided a provisional governance structure that could fit with the agri-food Pact for Skills intentions, figure 1

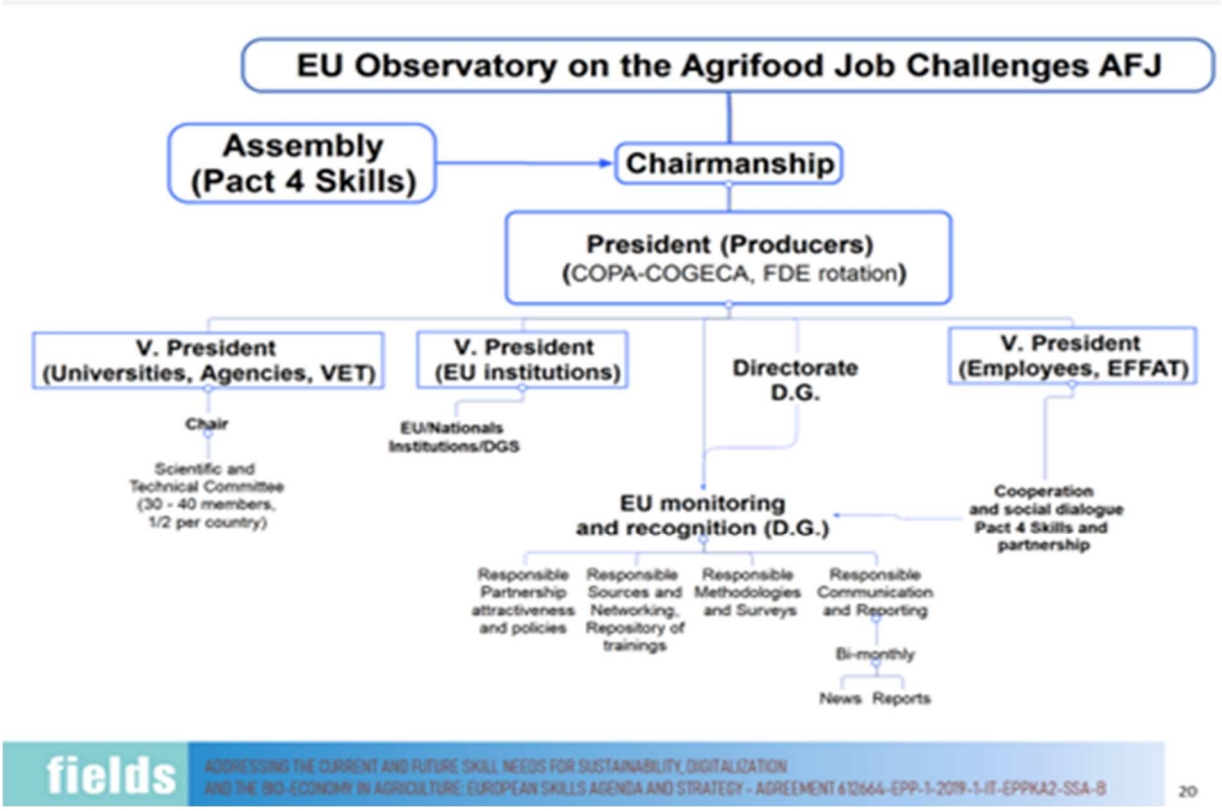

Figure 1 Provisional agri-food Pact for Skills governance structure

We conclude to the following principle

Principle 4: *Collaboration with stakeholders and governance of the partnership* *- FDE and Copa-Cogeca are spearheading the agri-food Pact for Skills, aiming at collaboration with a broad group of stakeholders* *- A governance structure should be designed to appreciate and underline different roles in the agri-food and forestry skills ecosystem to be established, in order to facilitate active participation.*

3.5 Learning content and structure

3.5.1 Training modules

The questionnaire included a question on coherent groups of skills within the job profile descriptions. Coherent groups of skills may form the basis for specific training modules, that next to the job profile training program may separately be of interest for specific target groups.

Key modules identified sometimes resembled the main items as described in the job profiles, however, most respondents could combine skills in coherent, logical groups, presuming a hierarchical structure of training programs: job profile - module – course.

The grouping of skills in modules differed among respondents, probably dependent on background and region of the responding organisation and on the skill needs considered most important by that respondent. This raises the question whether de development of standard education and training modules at European level would be the direction to go. However, the grouping of skills in training modules as performed by a number of respondents in this survey may be important input for the development of the national roadmaps in WP2.4 of the FIELDS

project and for the development of training programs in different regions and sectors (in WP 3 and 4, and beyond).

Nevertheless, there were also more general opinions among the respondents. Several respondents underlined the importance of basic and common modules including digital topics, job safety, basic principles of circular economy, basic principles of food production etc. Also, several respondents stressed the importance of a legal framework module, including labelling issues as well as consumer requirements; whereas also data gathering and basics of data management (incl. working with KPIs) were stressed by various respondents.

Next, the suggestion was posed by several respondents that the job profiles descriptions should also include some of the basic skills and knowledge requirements of the other profiles, e.g. the sustainability job profiles should also include a module on bioeconomy and vice versa. Finally, a proposal was to include a holistic view on the whole food chain in the sustainability and bioeconomy profiles, to stress the necessity to combine sector related and technical skills with entrepreneurial skills, that enable employees to look across the boundaries of the own function or firm.

Therefore, besides the differences in view among respondents on the structure of training modules, there are also quite some commonalities. Further inquiries into standardisation possibilities should better focus on ‘’basic’’ modules and/or on the level of single courses.

3.5.1.1. Modules as composed by respondents

This subsection gives an overview of modules as composed by respondents.

Agriculture

For the job profile Technician for sustainable agriculture key groupings of the items/skills in the job profile description were on Soil health and good agricultural practices, Biodiversity, Water/groundwater management, Adaptation and mitigation to climate change and management of emissions, Efficient use of resources/circular economy and energy management, Sustainable feed sources. One partner proposed a module on how to build up a farm demo network in sustainable agriculture.

For the job profile Technician for agriculture in bio-economy key groupings of the items/skills in the job profile description were on Planning and coordination of production, Performing farming operations in line with bio-economy and circular economy principles, Production techniques for non-food products, Crop diversification and crop rotation, Production of renewable energy, Waste management, Valorisation of organic fertilisers.

For the job profile Technician for agricultural digitalisation key groupings of the items were Farming activities and digitalisation (including e.g. general applications, legal framework and digital entrepreneurship), and separately for arable crops, livestock and mixed farming specific Digital applications and management information systems. One participant also mentioned a module on Fair data economy in agriculture, and data analytics.

Food industry

For the job profile Technician for Sustainable Food Industry, key groupings of the items were Sustainable use of resources (including water management, energy efficiency, sustainable sourcing etc.), Management of environmental impacts (including waste management, valorisation of by-products etc.), and Sustainable processing (including manufacturing technologies, packaging, safety and quality management systems etc.).

For the job profile Technician for Agri-food Digitalisation, typical technical modules were distinguished such as Digital management systems and Decision support systems, Data handling and processing, Data science and Statistics, Factory 4.0, Robotics and IoT. However, most respondents stressed the importance of the digital applications in the food industry, in e.g. Operating Systems and Manufacturing Technologies, Circular economy and digitalisation, Information systems in the fields of Logistics, Quality Management, E-commerce etc.

For the Job profile Technician for Food Industry Bio-economy typical modules defined were Food safety and quality Management, Operations management, Product development, Business development, Agribusiness and

supply chain management; next to modules like Circular manufacturing, and Environmental economics. An important consideration regarding the interpretation of the bioeconomy job profile(s) was how ‘’Bio-economy’’ is defined. According to a definition provided by the European Commission, the bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy independently of the processing technologies (https://ec.europa.eu/research/bioeconomy). However, some of the respondents applied the concept specifically to biobased non-food production, while for others it covers (all) business aspects of a farm, food industry, or food supply chain.

Forestry

For the Job profile Technician for sustainability, bioeconomy and digitalisation in forestry the following modules were mentioned: Trends, techniques, legislation, sustainability challenges in agro-forestry; New forms of businesses/entrepreneurship (e.g. social entrepreneurship, cooperative models), Making a business plan, Identification of soft/transversal skills through self-assessment (awareness building). Other more technical modules mentioned were Material and energy efficiency, Applications of digital solutions in forestry, Environmental and sustainability issues such as forest biodiversity conservation and water management, Wood science and technology, Agro- forestry, Value chain analysis and basics of (forest) economics. The importance of good STEM skills was stressed.

Annex 4 gives insight in the detailed analysis of modules for the Technician for Food Industry Bioeconomy profile by FIELDS partner ISEKI (annex 4a), and of the detailed analysis of modules for the Technician for Sustainable Agriculture by FIELDS partner AERES (annex 4b). These can be considered as examples on how training modules can be structured.

Principle 5: Modular structure of training programs

Job Profile training programs should be built in a hierarchical modular structure, including modules and sub-modules/courses. Standardization of training modules across Europe is difficult because of regional differences, target group differences, etc. Training standardisation possibilities should be investigated on the level of ‘’basic’’ modules and/or courses.

3.5.2 Management/entrepreneurship and soft/transversal skills

In Management/Entrepreneurial and soft skills, besides general business planning and management skills, including health and safety management, and (digital) entrepreneurship skills, key attention was given to relational skills, including staff networking and communication, negotiation, public speaking and English language, leadership and team management, food chain cooperation and interdisciplinary thinking.

For the agri-food profiles several respondents stressed the importance of Innovation management, Business development, Agri-food law, Quality, safety and certification, Critical and creative thinking, Knowledge of agri-food communities, Agro-tourism and local products. One respondent proposed a ‘’small MBA’’-like training module, including economics, marketing and sales, and consumer intelligence knowledge.

For the forestry sector typical skills mentioned were Basic knowledge (including language, terminology, knowledge of communities, digital tools), Social skills and communication, Thinking skills, Entrepreneurship (most of interest for self-employed people and managers), Customer service. Although, as was reported, needed transversal skills differ between type of job, e.g. managers, extension officers, technicians/researchers, material handlers, forest kindergarten teachers or heavy equipment operators.

These findings lead us to the following principle:

Principle 6: *Management/entrepreneurship and soft/transversal skills*

- In management/entrepreneurship and soft/transversal skills training, besides general business planning and management skills, including health and safety management, and (digital) entrepreneurship skills, key attention should be given to relational skills

- Therefore, a key part of management/entrepreneurship and soft/transversal skills training should cover learning to work collaboratively and cross-functionally (ultimately for the joint delivery of value to the customer).

Cross-functional skills are considered very important across job profiles, and perhaps critical for small business/companies, where all-rounder workers are often needed.. This may apply to in-company functions where employees must be able to communicate and collaborate with other functions, as well as to inter-company functions where employees must be able to communicate and collaborate with (functions in) other companies.

3.5.3 Training in practice

Working practices, working with real life problems, developing trouble-shooting skills are essential for most training modules. Further, there is a need for excursions (e.g. in agriculture to experimental farms), demonstrations and lectures by people with hands-on experience.

For the food industry job profiles practical training is required around food safety and quality management, production operations, typical agri-food specific bioeconomy related subjects, and working with automation and digital applications on industrial sites. However, sectorial differences should be taken into account in processes and equipment (conveyer belts, mixers, packaging etc.), as different skills may be required.

For the agriculture job profiles several areas of the sustainability and bioeconomy profiles are important in terms of practical experience, for example, waste prevention, soil health management and agro-environmental practices, production techniques for biobased crops, industrial crops. In the job profile for agricultural digitalisation in particular the digital applications in various farming functions need practical experiences.

Similar for forestry, digital skills and digital entrepreneurship, forest disease control and prevention, forest equipment/machinery and maintenance, and project management and business operations are important skills to be supported by practical experiences.

Next to these more technical skills, respondents in all three sectors underline the importance of practical experiences in communication skills, implying training of trainees in practice supported by a company mentor. Moreover, working in a company implies collaboration with various staff functions, and not just working in and for one department (e.g. think of a lab function during a whole internship period). Therefore, spending time in different departments/functions of a company in internships and with practical experiences is considered important. In this respect good mentorship at company level and consistency with learning objectives and guidance from the learning institute are required.

The presence of internship possibilities in a training program may stimulate young people to enrol. (e.g. 80% of Finnish Forest Industries Federation's member companies use apprenticeship contracts for both recruiting new people and further educating existing employees). Another group that might benefit from apprenticeship environments are migrant workers, to acquire understanding and experience on the job. Moreover, apprenticeships can also be of interest for trainees and staff members further in their career, for reskilling or upskilling for a new job.

This leads to the following principle:

Principle 7: *Include working practice in training programs*

Working practices, working with real life problems, developing trouble-shooting skills are essential for most training modules. This in particular holds for the more technical skills, although typical skills to communicate and collaborate with other functions also do need practical experience and guidance by company mentors.

3.5.4 Online training

The Covid-19 pandemic has stimulated a further move towards online education at all levels of education. On the one hand this has led in the last two years to short term delays, as in particular practical exercises had to be postponed; on the other hand it has supported an ongoing trend towards online or blended (people are becoming ‘’zoom-tired’’) education, in particular in these countries and regions with sufficient digital infrastructure provisions. In this respect, because of differences in access to computers and networks, Covid19 has also strengthened social inequality in online education.

Online training is supported through the fast development of tools, such as virtual reality applications, video intelligence, 3D animation, simulation tools (e.g. how to manage machines or production lines), etc. In general, online courses are better accessible and are wider available than in-class courses. However, engagement is often lower while, in general, interaction between teacher and trainees remains essential for many of the modules.

Respondents regarded the more theoretical modules, including, for example, legal framework and regulations, statistics and data analysis, DSS, health and safety management, (basics of) circular economy, other basics courses, etc. as suitable for online education and training.

However, for most modules a mixed approach is required. For these courses the ‘flipped classroom’’ approach can be applied, where online self-study and/or practice of students is combined with interactive classes (with, for example, group discussion, problem and case-based training), supported by a teacher.

The same holds for many of the management/entrepreneurship and soft/transversal skills, which can be taught online in the basics. However, application of these skills is important, in particular when collaboration and communication with other staff members or with companies in the supply chain should be learned in practical experiences and supported by mentorship (‘’learning by doing’’).

Also, for the more technical skills of the profiles on Bioeconomy, Sustainability and Digitalisation holds that the basics can be taught online, however, advanced and applied knowledge/skills require in many cases practical training and real visits at factories, farms, forestry businesses. Moreover, new technologies like robotics and artificial intelligence, drones, cloud computing and block chain as well as developments around data protection (regulations) and data privacy will require new skills, which can partly teach online but also need practical experience.

For online training basic digital skills and equipment are necessary. At the start of a course or module, digitalisation skills of trainees should be measured, as simple as possible, according to the requirements of that specific course or module. Depending on the level of skills of the trainee supplementary courses should be offered. Customisation of educational procedures is a must in this regard, while training materials should be suited for a diverse EU population (language, culture, education level).

Particular attention should be given to rural communities, with poor internet connection. In this regard high speed internet is of key importance for rural areas. Main challenges are related to connectivity, network quality, the lack of interoperability of industrial systems. But also, the availability of digital equipment needs much attention. The latter in particular applies to underprivileged groups, who don’t always have the financial means to participate.

Based on these findings the following principle is formulated:

Principle 8: *Make full use of online education and training possibilities*

- In the design of new courses, we strive for an optimal balance between online education (e.g. flipped classroom), face-to-face education, and in-company practice. The development towards online education will continue; therefore, we integrate it in all modules and courses.

- Besides the necessity to improve internet access and access to computer equipment across Europe (part of the EU Digitalisation Strategy), basic digitalisation training courses (online and in-class) should be developed throughout Europe. With easy access to farmers, food industry employees and foresters. One step could be to offer online (basic) courses for free and offer license free webinar tools.

3.6 Target groups

Target groups

Respondents reported various target groups. First, students and recent graduates, VET levels 3, 4, 5, although several respondents regarded level 3 as a prerequisite for the training modules discussed. A second target group are industry employees, e.g. age most between 30 and 50. Upskilling and reskilling are important in this group. In the food industry this group includes maintenance technicians, engineers, but also location managers and to-be directors and top-professionals of large(r) companies. In the agriculture domain farmers (individual or as coop members), workers in the field, agricultural advisors (incl. agronomists, agricultural technicians, environmental project managers) are main representatives of this target group. Upskilling in fast developing areas like digitalisation and food processing is very important in this group. A third target group are roughly the group > 50 where upskilling becomes most relevant. Think in this regard of upskilling in highly automated industries, where data control is important (e.g. stock and sales data), or in the agriculture domain the upskilling in digitalisation processes at the farm.

Underprivileged groups and gender issues

Most respondents didn't recognize any gender issues in the job profiles discussed, although some functions might be gender related. For example, production operations often ask for more strength and, therefore, are often performed by men; while HR functions and functions related to quality, safety and sustainability are more performed by women. As one respondent stated "forest management and wood science and technology are always believed to be fields of men". In general, however, gender should not play any role, therefore, existing European and national directives should be further put in place.

In every-day practice women often have a disadvantaged position. In particular relatively few women do have a leadership role in the industry, which needs attention, both in (tailoring of) training modules as well as in life-long learning courses. For agriculture, respondents mentioned special attention needs for female farmers and for decision making functions at both farms and cooperatives. Although, mechanisation and automation of farming processes may stimulate women participation in farming. A special point mentioned regarding gender issues was the disadvantaged position of women after maternal leave. Moreover, reskilling of women who have been out of a job for years is a topic that needs attention.

Similarly, under-privileged groups and cultural diversity should remain a point of attention. Indeed, certain groups may encounter pressure for certain choices. In general, under-privileged groups, low-income workers and migrants might need financial support and support, through information and communication, to access courses. Next, labour mobility and migration need extra attention in terms of language and adjustments. These workers should receive sufficient background information about country and sector to understand specifics about business operations. Internationalisation of training content is important. A group that needs specific attention are seasonal foreign harvest workers, who are often lowly educated. Pre-education, e.g. in "simple" language, emphasizing graphics, etc. may be important.

Finally, older workers, who are not familiar with latest developments might need courses of flexible duration and content, as well as specific attention to language issues if needed. Currently less than 2 out of 5 adults participate in learning every year (EU, 2020). As both in agriculture and forestry many older farmers/employees

will retire in the next 10 years, the need for new employees will increase as well as the need for continuous learning.

This leads to the following principle regarding target groups:

Principle 9: *Tune training with target groups*

- In the development of modules three generic target groups can be distinguished: 1. Students and early graduates (level 3, 4, 5), 2. Industry employees, to train for new and fast developing functions or for upskilling, 3. Older employees, in particular aimed at upskilling

- Under-privileged groups, low-income workers and migrants might need financial support and advice to access courses. Labour mobility in general needs extra attention in terms of language differences and adjustments based on trainee's background.

- Gender issues should be pre-assessed, in particular in training for tasks that is considered ''masculine'' or 'feminine'', and in soft skills modules. Special attention must be paid to women job returnees (upskilling).

3.7 Resources

This topic included questions on lack of time and resources of potential trainees, how to raise interest for certain jobs and training and how to create ''inspiring learning environments''. The answers of the respondents resulted in a long list of ''tools'' that we grouped into four categories: timing, structure, communication and funding.

Table 4: Timing tools

- Design flexible and interactive e-learning courses, e.g. supported by decentralized webinars
- Schedule in off peak time (evening, weekends) or in hybrid mode. In general, adapt time schedules according to the availability of the trainees
- Divide modules/training in short lessons (e.g. <= 1 hour)
- Make modules/training courses complementary and diminish overlapping.
- Design Fast Tracks for business management
- Make courses tailor made to use time most efficiently

Table 5: Structure tools

- Organize modules in macro-topics to guarantee coverage, composed of micro topics that can be followed independently.
- Invite trainees with complementary back ground and design (multi-disciplinary) problem based courses
- Include social entrepreneurship as a topic to learn trainees a ''sustainability mindset'' with a long term vision on a sustainable bio-economy.
- Include hands-on experience and use real life cases and applications, showing connections with the newest technology. Hold industrial sessions and field visits, active exercises and group work, speakers from practice, in-company training, lab sessions in work environments and/or work in consulting-like projects. Bring in fun!
- Use technologies such as augmented reality and simulation; fascinating videos (e.g. of employees and of employers), game based resources, and online tools
- Gaming is an increasing way to make working more practical and fun and is used in e.g. introduction to new employees and in learning codes of conduct
- Support internships if possible. Develop internship schemes with vacancies funded by a grant system
- Ensure that trainees serve in different departments during their traineeship so that they can get different experiences from different roles.
- Let trainees develop a small project during their traineeship.
- Organize (certified) webinars for specific subjects
- Legislation making it mandatory for large companies to create traineeship opportunities.

Table 6: Communication tools

- Make participants fully aware of what they will learn. Define clearly your learning outcomes
- Organize active promotion at education institutes and at agri-industry meetings and platforms. Combine with campaigns: online, press releases, newsletters, leaflets, weblinks, etc.
- Cooperatives, associations and similar organizations should be actively involved in interest raising among potential trainees. National and regional bodies are closer to the daily practice and, therefore, more suited to raise interest.
- Clearly communicate the benefits through captivating programs, job opportunities, statistics showing improvements in job positions, job experiences/testimonials and success stories, food chain presentations. Explain that farmers can be entrepreneurs. For example, FIELDS partner PROAGRI was part of a consortium that built, an ''E-college for regenerative farming'' https://www.uudistavaviljely.fi/briefly-in-english It is freely available and according to PROAGRI with great success among farmers and advisors.
- Promote a good working environment and continuous improvement through training
- Emphasize the meaningfulness of jobs (the production of healthy, sustainable and high-quality food). see for example ''Farmers of the future'' (https://publications.jrc.ec.europa.eu/repository/handle/JRC122308)
- Address the importance of national/ regional production
- Give an introduction course on the Global food industry
- Not only promote the job, but also the sector (attractiveness of the sector is key)
- Modules and courses should be certified. Micro credentials should be offered, and trainees should receive formal certificates.

Table 7: Funding tools

- Provide e-learning for free, via e-learning platform (excl. a certificate)
- Invite externals for free (social entrepreneurship)
- Financial support through EU programs, national funds and scholarships on competitive basis. For example, the Covid 19 recovery plan (NextGenerationEU) as well as the investment pillar of the Green Deal give new opportunities for sectors in transition such as agriculture, food industry and forestry.
- Financial support of companies (for employees), private corporate and public scholarships for internships, compensation of training time, or sabbatical like approach. For example, in Finland there is a system in apprenticeship training where the government funds traineeships by handing ''trainee allowances'' to employers.
- Link subsidies to training certificate requirement (for example organic farmers need to follow a 5-day course to achieve subsidy
- Individual learning accounts available in EU countries could grant funding.

The following principle on training resources is formulated:

Principle 10: *Optimal use of resources*

In the design of modules and courses specific attention should be paid to 1. timing (align the course schedule to the trainee's availability), 2. structure (the aim is learning for practice), 3. communication (on the benefits for the trainee), 4 funding (to enable participation financially).

3.8 Resilience

According to the respondents all job profiles indeed are quite dynamic in content, as necessary skills are continuously updated. This might be less true for a number of management/entrepreneurial and soft skills courses, where content does not change overnight, however the practical applications of these skills will. In this regard all modules should be regularly updated towards the newest principles, technology and knowledge.

New sustainable processing technologies, principals of circular manufacturing and waste management, and digital technologies are examples of fast changing functions in the food industry that require regular updates in training modules and courses. Precision agriculture and advanced digital skills, water/groundwater management, energy efficiency and renewable energy, waste prevention and valorisation of by-products, and feed sources are examples of fast changing functions in agriculture. Examples in forestry are digital forestry and GIS, biobased products, ecosystem services, forest pest and disease management.

In the design or updating of courses, the focus should be on rapid developing areas of science and technology and the evolution of new applications in practice. Moreover, training modules can be up-dated with cooperation of businesses, which have the most up-to-date insight in skill needs. To support training programs best practice case histories can add to show developments in time.

Keeping courses updated is in particular important for SMEs in general and specific target groups such as newcomers in industry, as well as for Live Long Learning objectives. One respondent states that updating of training should be mandatory in future education. Interesting to see is that several respondents stress the importance of life-long learning of business/entrepreneurship and soft skills with items such as analytical, critical and creative thinking, project management, strategic thinking and job safety. In general, all modules are considered suited for Life-Long Learning trajectories.

Principle 11: *Strive for resilience in training programs*

In the design of a module or course an update cycle should be built in. Updates should be based on KPIs defined for training programs and courses. The frequency of updates can differ between modules and courses. Pay attention to developments (science, technology, principles) in different disciplines and requirements of businesses.

4. Conclusion and path forward

In this report we defined 11 principles for a European strategy on agriculture, food industry and forestry skills, based on the results of a questionnaire survey among key European players in agri-food vocational education and training. These organisations are partners in the Erasmus+ FIELDS project.

Principle 1*: contribute to harmonization of the agri-food and forestry skills ecosystem*

- A common European catalogue and repository of training modules together with a system of micro credentials should be designed, linked to national catalogues to define specific needs.

- This should be aligned with a harmonized certification system for VET courses/programs and VET providers. Agreement between public and private parties on the catalogue and certification system is essential, to co-create the new skills ecosystem and to unlock public and private funds.

Principle 2: *a supra-national institute/organisation should be responsible for design and maintenance of a monitoring infrastructure for skills.*

The system should be smart, user friendly, upgradeable and interoperable. The many examples of monitoring systems working on national and multi-national level should be the starting point of the development of a European skill monitoring infrastructure.

Principle 3: *KPIs are needed for ongoing assessment of the skill partnerships (Pact for Skills) and for assessment of training modules/courses.*

KPIs can be used for monitoring progress and outcomes and to take decisions on the way to go forward. A system of KPIs should be limited in complexity, transparent and user friendly.

Principle 4: *Collaboration with stakeholders and governance of the partnership*

- FDE and Copa-Cogeca are spearheading the agri-food Pact for Skills, aiming at collaboration with a broad group of stakeholders

- A governance structure should be designed to appreciate and underline different roles in the agriculture, food industry and forestry skills ecosystem, in particular the agri-food Pact for Skills, in order to facilitate active participation.

Principle 5: *Modular structure*

- Job Profile training programs should be built in a hierarchical modular structure, including modules and sub-modules/courses.

- Standardization of training modules across Europe is difficult because of regional differences, target group differences, etc. Training standardisation possibilities should be investigated on the level of ''basic'' modules and/or courses.

Principle 6: *Management/entrepreneurship and soft/transversal skills*

- In management/entrepreneurship and soft/transversal skills training, besides general business planning and management skills, including health and safety management, and (digital) entrepreneurship skills, key attention should be given to relational skills

- Therefore, a key part of management/entrepreneurship and soft/transversal skills training should cover learning to work collaboratively and cross-functionally (ultimately for the joint delivery of value to the customer).

Principle 7: *Include working practice in VET*

Working practices, working with real life problems, developing trouble-shooting skills are essential for most training modules. This in particular holds for the more technical skills, although typical skills to communicate and collaborate with other functions also do need practical experience and guidance by company mentors.

Principle 8: *Make full use of online education and training possibilities*

- In the design of new courses we strive for an optimal balance between online education (e.g. flipped classroom), face-to-face education, and in-company practice. The development towards online education will continue; therefore, we integrate it in all modules and courses.

- Besides the necessity to improve internet access and access to computer equipment across Europe (part of the EU Digitalisation Strategy), basic digitalisation training courses (online and in-class) should be developed throughout Europe. With easy access to farmers, food industry employees and foresters. One step could be to offer online (basic) courses for free and offer license free webinar tools.

Principle 9: *Tune training with target groups*

- In the development of modules three generic target groups should be distinguished: 1. Students and early graduates (level 3, 4, 5), 2. Industry employees, to train for new and fast developing functions or for upskilling, 3. Older employees, in particular aimed at upskilling

- Under-privileged groups, low-income workers and migrants might need financial support and advice to access courses. Labour mobility in general needs extra attention in terms of language differences and adjustments based on trainee's background.

- Gender issues should be pre-assessed, in particular in training for tasks that is considered ''masculine'' or 'feminine'', and in soft skills modules. Special attention must be paid to women job returnees (upskilling).

Principle 10: *Optimal use of resources*

In the design of modules and courses specific attention should be paid to 1. timing (align the course schedule to the trainee's availability), 2. structure (the aim is learning for practice), 3. communication (on the benefits for the trainee), 4 funding (to enable participation financially).

Principle 11: *Strive for resilience in training programs*

- In the design of a module or course an update cycle should be built in. Updates should be based on KPIs defined for training programs and courses.

- The frequency of updates can differ between modules and courses. Pay attention to developments (science, technology, principles) in different disciplines and requirements of businesses.

These principles should be further discussed with FIELD partners, the agri-food Pact for Skills organisation and other European stakeholders, to be used as a framework with three objectives:

1. to support further steps in the FIELDS project:
   - the design of the national roadmaps in WP2.4
   - for program and training development in subsequent FIELDS WPs
2. as an intermediate report towards Deliverable D3.2 of the FIELDS project (D2.3 - Month 45, September 2023)
3. to support a European agri-food-forestry skills strategy, in particular to support the agri-food Pact for Skills

Objectives 1 and 2 will be attended to in the second half of the FIELDS project, years 2022 and 2023.

For objective 3, after discussion with FIELDS project management and some FIELDS partners, we decided for three specific follow-up actions:

- Set up a working group to define the outline of an agri-food skills monitoring system
  - taking existing knowledge and experiences as starting point (see EU-level and national examples earlier in this report)
  - aiming at a "light" structure
  - in alignment with EU level stakeholders (Eurostat, Cedefop, EU Education & Training Monitor, and others)
- Set up a working group to define KPIs to be monitored
  - starting with the lists of KPIs as proposed in this survey
  - aim is to define a minimum number of KPIs delivering a maximum level of decision support. (transparency, user-friendliness, simplicity are key words for the assessment system to be designed)
  - learning from existing systems in other sectors (for example, KPIs designed by the automotive pact for skills https://automotive-skills-alliance.eu/index.php/pact_for_skills/ ;a skills partnership self-assessment rating sheet, developed in US https://www.michigan.gov/documents/SPSAT_99403_7.pdf
  - tuned with the European agri-food skills ecosystem monitoring system
  - in consensus with European stakeholders
- Support the agri-food Pact for Skills to further develop the agri-food skills partnerships and its governance structure
  - By supporting an observatory like structure as proposed by Confagricoltura (see earlier in this report), with functions such as:
    - A monitoring system,
    - Analysing the impact of different measures, tools, policies
    - Communicating bi-monthly results and initiatives
    - Suggesting best practices and solutions for new needs
    - Advancing medium and long-term EU and national scenarios
    - Facilitating arbitrages on conflicts and consensus policies
    - Listening frequently to main stakeholders
    - Consulting yearly the scientific communities and VET providers

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Annex 1 Documentation of selected topics for the survey questionnaire

EU level harmonisation of skills

At the level of the EU, harmonization of (vocational) education and training across sectors and countries is considered one of the key challenges to overcome skill gaps and to reach sustainable competitiveness for the agriculture, food industry and forestry sectors (European Union, 2020; European Union, 2018). This aim is supported by multiple stakeholders in Europe, as formulated by (EfVET, 2019): the European Education Area for VET should be further established, joint qualifications in VET should be promoted, including Europe-wide recognition, ECVET and interchangeable modules.

Action 1 of the European Skills Agenda has established the Pact for Skills, which brings together private and public stakeholders who share the objective of up- and reskilling the workforce in Europe. Since its launch Pacts for Skills have been set up for different sectors, such as the automotive sector, the micro-electronics sector and the aerospace and defence sector. The Pact for Skills partnership for the Agri-Food Sector as proposed on the 18th of October 2021, states in the outline of its program ‘’.. the investment and alignment of initiatives is needed all around European Member States to provide the right education and skills needed by the sector today and tomorrow’’ (FoodDrinkEurope-Copa Cogeca, 2021). Intentions of the pact are:

- sectoral cooperation and monitoring based on the commitment of all stakeholders involved
- systematic EU-wide recognition of skills and knowledge
- EU-wide mutually accepted definitions of skills and job roles
- competences categorized by targeted working profiles

Monitoring of the agri-food skills ecosystem

Action 2 of the European Skills Agenda (EU, 2020) aims to strengthen and disseminate skills intelligence, including at regional and sectoral levels. The EU agency CEDEFOP (www.cedefop.europe.eu) will deliver a strong contribution to achieve these objectives.

Monitoring requires longitudinal studies that go beyond political mandates at EU and member state level (LLLP, 2020a). Therefore, independent national structures and supra national structures should be developed to design and maintain a skills ecosystem monitoring system.

On sectoral level, the agri-food Pact for Skills partnership (FoodDrinkEurope-Copa Cogeca, 2021) stresses the importance of a European agri-food skills ecosystem monitoring system. This means that partnerships have to be built composed of a diverse range of stakeholders including advocacy groups, farmer organisations, industry organisations, education institutes, etc.

Key performance indicators

The EC points at the importance of having key performance indicators to monitor current and future skills, in order to develop policies to better match demand and supply of skills. ‘’Accessible, easily understandable, targeted and up-to-date skills intelligence is necessary. Besides graduate tracking surveys and administrative data matching, artificial intelligence and big data analysis have great potential’’ (EU, 2020).

Therefore, development of a range of KPIs for the agriculture, food industry and forestry sectors is essential to keep track of developments and trends in demand and supply of skills, for policy making, but also for businesses and education and training institutes, to be able to improve current training programs and to design innovative training to match emerging demands in these sectors.

Partnership and governance

Lazaro-Mojica and Fernandez (2021) underline the importance of a multi-stakeholder public-private partnership approach for the agri-food Pact for Skills, bringing together academia, industry, government, end-users and citizens. Because of the complexity of the partnership and its tasks, covering multiple sectors and countries, with

different structures, development levels and aims in sustainability, bio-economy and digitalisation, a sound governance structure is needed (LLLP 2020b).

Some examples and considerations from other partnerships and organisations:

- The Pact for Skills of the automotive ecosystem works with 4 working groups: Horizontal, Communication and Dissemination, Skills intelligence, Regional implementation
- According to the EfVET survey of 2018 (EfVET, 2019) separate responsible authorities for general education and VET are needed. Such an approach could affect a Pact for Skills governance structure.
- How to link up with interest and policy groups, for example the link with an LLL interest group of the European Parliament (LLLP, 2020c).
- How to link up with European level organisations such as EQAVET,
- How to organise the connection with local and grassroots organisations (LLLP, 2020c).
- How to reflect on different perspectives in education and training: institutional, pedagogical, and socioeconomic (compare e.g. CEDEFOP, 2020).

Learning structure

Modules

In tasks 2.1 and 2.2 of the FIELDS project job profiles in the areas of sustainability, bioeconomy and digitalisation have been designed. Every job profile includes a description of essential skills, essential knowledge, optional skills and optional knowledge. To cover these skills and knowledge training programs must be designed, consisting of courses for training of skills. However, courses on similar subjects (for example, waste management, recycling) can be combined in modules. The exercise in the survey was to see whether logical modules can and should be composed. Modules and courses could be applicable to more job profiles and also for the specific interests of target groups. Although, the construction of modules differed across respondents, it is clear that future development of training programs for the selected job profiles can use the insights from this survey.

In this respect, we should also have an open eye for the grouping of skills in training modules as suggested by industry and societal trends, and by parties in the field. For example, for the food industry FoodDrinkEurope provided a study on new professions and career paths in the food and drink industry (Effat/FoodDrinkEurope, 2020), including emerging jobs and the new skills and types of qualifications required.

Management/entrepreneurship and soft skills

The FIELDS WP1 activities (focus group discussions on skills and training needs, a survey on skills and training needs, as well as a trend and scenario analysis) pointed at the increasing interest in management/entrepreneurship and soft/transversal skills. The important position of these skills for any job profile is underlined by many studies and policy report (e.g. Cedefop, 2020; LLLP, 2020b-c; Lazaro-Mojica and Fernandez, 2021; ILO, 2019).

Learning in practice

We see a move towards experiential (LLLP. 2020a), participative and active learning. Apprenticeships/internships are regarded throughout the VET literature as essential for achieving required skill levels. This is reflected by results of the EfVET survey of 2018 (EfVET, 2019) which show that most European stakeholders strive for further strengthening of the position of practical learning, with aims such as: to increase high level internships for EQF – levels 3 and 4, to advocate for an improved cooperation between schools and employers regarding apprenticeships and work-based learning, and to allow companies to take part in curriculum development. The European Alliance for Apprenticeships (EU, 2021d) provides a public-private platform for stakeholders aiming at strengthening the quality, supply and image of apprenticeships in Europe, and promoting the mobility of apprentices. On policy level, the EC strives for a system of nationally recognized qualifications, with the apprentice being paid or compensated (EU, 2018).

Online learning

Online education and training is growing fast in the last decade, and in particular in the last two years reinforced by the Covid-19 crisis. The European Digital Action plan (EU, 2021b) underlines the presence of digitalisation deficiencies throughout Europe and stresses the importance of digital skills and digitalisation of learning. On the one hand education and training have the opportunity to follow the digital transition in Europe, on the other hand digital skills can support and strengthen the sustainability transition (ILO, 2019). In this regard the European Skills Agenda (EU, 2020) points at several instruments, such as short courses to reskill workers, ICT-jump-start trainings, Digital crash courses for SMEs. At the same time these changes also require new skills for educators/trainers. The European Digital Competence Framework for Educators (https://ec.europa.eu/jrc/en/digcompedu) provides a framework of key competences for trainers in digital education.

Target groups

Target groups for the programs, modules and courses are formed by the European working force. For our job profiles these are people working in agriculture (farmers, advisers, etc), employees in the food industry (process engineers, marketeers, etc.) and foresters (conservation technicians, forest workers, etc.).

However, there are many differences between target groups within the European work force, in: age, gender, country, cultural back ground, language, etc.

In line with the Paris Declaration of 2015 (EU, 2016) education and training should support

- acquisition of social, civic and intercultural competences

- enhancing critical thinking and media literacy,

- fostering the education of disadvantaged children and young people,

- promoting intercultural dialogue

This position is confirmed in the 2018 EfVET survey (EfVET, 2019): equality of VET learners should be guaranteed. Moreover, social fairness is one of the pillars of the European Skills Agenda (EU, 2020)

Specific attention in this respect is given to adult education (EU,2020; LLLP, 2020 a,b,c), as participants in adult education have different backgrounds and experiences, indicating that their needs should be addressed at an individual (or sub-group) level (EfVET, 2019).

Resources

Our focus is on how access to training and education for learners can be stimulated.

Time and finances are important resources for learners to access education or training. The 2016 Eurostat adult education survey showed that training and education access barriers are often linked to time constraints through e.g. family obligations or work) as well as financial constraints and the lack of ‘’prerequisites’’ (entry qualifications) (LLLP, 2020c).

The European Skills Agenda (EU, 2020) suggests Individual Learning accounts and also the establishment/promotion of micro-credentials to give learners the means and motivation. The stakeholder consultation round for the establishment of individual learning accounts throughout Europe has recently been finalized (12 December 2021). Micro-credentials enable learners to focus on specific training with less investments in time and money, while at the same time the training effort is recognized.

Also, other measurements can stimulate potential trainees to enter education and training trajectories. (EfVET, 2019) concluded to the following VET supporting measurements: earlier promotion of VET (starting in secondary school), more independence for VET providers, upskilling of teaching skills, more political support and acknowledgement of the role of VET, promote attractiveness of VET between parents, strengthen the link between VET and the labour market.

Next to promotion and communication actions (LLLP, 2020c) stresses the importance of "dynamic and innovative pedagogies, andragogy, and cross-sectoral approaches, that bridge learning and everyday life", next to "factors that drive people to learn, ranging from financial incentives and improved career prospects to personal leisure and curiosity, which are inherently complex and personal"

For in-company training of employee's company support (in time and money) and career prospects may need specific attention. Examples of a toolbox for upskilling and reskilling in companies can be found in (EFFAT/FoodDrinkEurope, 2019). The toolbox includes tools/best practices for the recruitment of new and skilled employees for the food industry and for managing an ageing workforce.

Resilience

The twin green and digital transition continuously asks for enhanced and new skills in the labour market. For the education and training systems this implies continuous renewal of education and training programs to upskill and reskill the European labour force (EfVET, 2019; Cedefop, 2020; EC, 2020).

At the same time these developments underline the need of life-long learning, including providing guidance to the needs of the future workers in close cooperation with companies. In this respect, adult learning is determined by several factors including educational attainment, employment status, occupational category, age and skills. (LLLP, 2020c). Life-long-learning not only applies to learners, (EU, 2018) points at the importance of the initial and continuous professional development of VET teachers, trainers and mentors in both school- and work-based setting.

Action nr 8 of European Skills Agenda is the Skills for Life action (EU, 2020). [the Commission] "will aim towards building comprehensive, quality and inclusive adult learning systems, which reach out to all, including seniors and in particular those most in need of access to learning"

Annex 2: questionnaire

Please insert your answers, in different color letter type, below the related question. *(Even if you are not an expert on the topic, your opinion/insight will be valued!!)*

Training modules

1. What specific training modules (coherent groups of skills) do you recognize in the job profiles? (NB in this questionnaire one job profile includes more than one training module, where *we focus on the essential skills and essential knowledge*)
2. What are **key** management/entrepreneurial and soft skills fitting with a certain job profile and training modules? (please use the skill list from the ''Basic Module for each occupational profile'' as defined in WP2.1)
3. For which training modules (coherent groups of skills) is practice most important? How to connect to working practice? What role do you see for apprenticeships?

Target groups

4. What would be the most important business functions in your sector (not the identified job profile) that could gain from the different training modules?
5. Can you identify specific target groups (e.g. age, education level, cultural background, ...) for these training modules? For which target groups the identified training modules are essential for job retention (i.e. through upskilling)? Can you give examples?
6. For which training modules gender issues play a role (access to training and/or jobs because of cultural values, ...). And with respect to underprivileged groups you are aware of?
7. Do social and demographic change (aging of workers, labor mobility, increasing number of migrant laborers) impact on the training modules distinguished? How to take these effects into account?

Resources

8. How to deal with lack of time or funding of potential trainees? (if possible please give examples for training modules as identified).
9. How to raise interest among potential trainees? (e.g. for a course with only longer term benefits)
10. Can you think of specific resources supporting inspiring learning environments for the trainees?
11. How to improve attractiveness of the jobs (profiles)? Can you give examples?

Online training

12. What are typical training modules that are suited for online training?
13. How to deal with digitalization skills deficiencies (like e.g. basic computer skills) among potential trainees?
14. Because of COVID a move to more online education may be expected. Do you recognize this in your sector? Are there short-term consequences for the training modules identified?

15. What are main challenges in the digital education infrastructure in Europe with respect to these job profiles and training modules?

Skill ecosystem resilience and monitoring

16. Skill (and training) needs are developing fast. Which of the training modules in the job profiles is most dynamic in your opinion? How can training modules be made dynamic? Which should have priority for a dynamic set-up?
17. Which training modules are most suited for life-long learning? Which target groups (SMEs, farmers, age, gender, etc. ?)
18. Are you aware of monitoring practices to monitor the skills ecosystem and to identify dynamic skill/training needs? Think of elements such as skill needs, available training, re-skilling opportunities (e.g. to stimulate labor mobility), job opportunities
19. What are main challenges to come to a European skills monitoring infrastructure? Which organizations/institutions should be responsible for managing such an infrastructure?

Harmonization and exchange of VET

20. What are main challenges you are aware of, to exchange and harmonize training modules and best practices in the EU for these job profiles (different education systems, different training needs, national regulations ...?)
21. What are typical challenges to raise consensus between policy makers, companies and VET providers on a European skills agenda?

Partnership

22. What are key partners to be included in an Agrifood or Forestry Pact for Skills? Please look whether the below mentioned group of stakeholders is complete, whether you can add important stakeholders or whether stakeholders mentioned should be left out.
    - Considering groups of stakeholders (adapted from D1.3 page 4)
        - VET providers (VET schools, VET providers, HEI, other educational providers)
        - Policy makers (EP, DG EAC, DG EMPL, DG AGRI, etc., ministries, regional governments, regulatory bodies)
        - Decision makers (farmers, coops, foresters, industries, students)
        - Advocacy (representative bodies (e.g. Copa-Cogeca FoodDrinkEurope, ETPs, Pact for Skills), advisers, coops, unions, chamber of agriculture, student societies, other professional organisations and intermediaries)
    - European level partners, such as: Copa-Cogeca, FDE, ISEKI, CEPI, EfVET, LLLP, Cedefop, EIP-agri, ETPs, European federation of food science and technology (EFFoST), Safe and sustainable food system partnership (SSFS), Professional organizations, ...?

23. How should governance of a European public-private pact for skills be structured, e.g.
    - decision makers
    - funding
    - incentive structure for participants
    - ....

Assessment of the partnership and of training modules (please select and/or define indicators that you think are most important)

24. How to assess a pact for skill partnership? For example:
- Stakeholders actively involved
- Communications
- Impact on training programs
- ....

25. Which are key indicators to measure performance of a training module? For example, e.g.:
- Number of students, companies, participants from underrepresented groups
- Achievement of learning goals and student evaluation of training modules
- Flexibility of programs (hours, ECTS, online/face-to-face, ...)
- Renewal of programs (new elements added year to year)
- Resources per module (human resources, financial, technology...)
- .....

Annex 3 Partnerorganisations in Erasmus+ FIELDS

	Partner		
N°	**Organisation**	**Acronym**	**Country**
P1	Univeristà degli Studi di Torino	UNITO	Italy
P2	CONFAGRICOLTURA	Confagri	Italy
P3	Wageningen University	WUR	Netherlands
P4	ISEKI-Food Association	ISEKI	Austria
P5	Irish Co-operative Organisation Society	ICOS	Ireland
P6	Aeres	Aeres	Netherlands
P7	AGRAR Plus Beteiligungsges.m.b.H.	AP	Austria
P8	University of Hohenheim	UHOH	Germany
P9	Centre for Research and Technology Hellas	CERTH	Greece
P10	Association de Coordination Technique pour l'Industrie Agroalimentaire	ACTIA	France
P11	GAIA EPICHEIREIN	GAIA	Greece
P12	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal	Confagri PT	Portugal
P13	Cooperativas Agro-alimentarias de España	SCOOP	Spain
P14	Gospodarska zbornica Slovenije Zbornica kmetijskih in živilskih podjetij	GZS-ZKŽP CCIS	Slovenia
P15	Lebensmittelversuchsanstalt/Food Research Institute	LVA	Austria
P16	Universidad de Castilla-La Mancha	UCLM	Spain
P17	ASSOCIATION DES CHAMBRES D'AGRICULTURE DE L'ARC ATLANTIQUE	AC3A	France
P18	Spanish Federation about Food and Drink Federation	FIAB	Spain
P19	FoodDrinkEurope	FDE	Belgium
P20	FENACORE - Spanish Irrigation Consortium	FENACORE	Spain
P21	INFOR ELEA	INFOR ELEA	Italy
P22	FEDERATION OF HELLENIC FOOD INDUSTRIES	SEVT	Greece
P23	Lifelong Learning Platform	LLL-P	Belgium
P24	Association Nationale des Industries Alimentaires	ANIA	France
P25	European Technology Platform “Plants for the Future”	Plant ETP	Belgium
P26	ENGINEERS FOR BUSINESS IPIRESIES TECHNOLOGIAS KAI MICHANIKIS ANONIMI ETAIRIA	EFB	Greece
P27	Proagria	PA	Finland
P28	HBLFA Francisco Josephinum - BLT Wieselburg / Josephinum Research	FJ-BLT	Austria
P29	European Forum of Technical and Vocational Education and Training	EfVET	Belgium
P30	Confederation of European Paper Industries	CEPI	Belgium
AP01	Asociación Gallega De Cooperativas Agroalimentarias	AGACA	Spain

Annex 4a ISEKI – Modules for Technician Food Industry Bioeconomy profile

Questions 1 and 2 for the Food Industry Bioeconomy profiles (EQF 5)

Training modules

What specific training modules (coherent groups of skills) do you recognize in the job profiles? (NB in this questionnaire one job profile includes more than one training module, where *we focus on the essential skills and essential knowledge*)

Proposed training modules (blue: OP essential skills + green: OP essential knowledge):

1. **Module Food safety and quality:**
   - Quality management assurance and control
   - Food safety management, hygiene and control
   - Labelling and Ingredients
   - Traceability
2. **Module Production operations:**
   - Production operations and management
   - Emerging technologies
   - Energy efficient production methods
   - Continuous improvement
3. **Module Product development and packaging:**
   - Product development
   - plant-based food
   - biobased products
   - Packaging; bio-based Food Packaging
4. **Module Sustainability:**
   - Sustainability
   - Ethics for food
   - Food security
   - Climate change
5. **Module Bioeconomy**
   - water reuse
   - Side stream valorisation (from food industry, from farm) and co-products
   - Biomass transformation
   - Food waste reduction
   - Bio-economy and circular economy principles
   - Renewable energy production and use
6. **Module Regulations:**
   - Regulations
   - Bioeconomy regulation framework

Please note that we suggest the skill "Health and safety management" to go to the basic module of the educational profile. Perhaps in the BASIC KNOWLEDGE group of skills along with "job safety".

Essential skills	From the core curriculum (Module Soft-skills and Entrepreneurship): - Soft skills; - ICT Essentials: core digital skills - Job safety: Safety of workers and health, health and safety management Quality management assurance control Food safety management, hygiene and control Continuous improvement Production operations and management Traceability Food waste reduction; Product development

Essential knowledge	Sustainability: Ethics for food; water reuse; Climate change; Side stream valorisation (from food industry, from farm) and co-products; Bio-economy and circular economy principles, Energy efficient production methods Regulations; Food security; Labelling and Ingredients; Bioeconomy regulation framework
	Health & safety management (specific risks on top of the main curriculum) Emerging technologies Plant based food; biobased products Biomass transformation Packaging; bio-based Food Packaging Renewable energy production and use

What are **key** management/entrepreneurial and soft skills fitting with a certain job profile and training modules? (please use the skill list from the ''Basic Module for each occupational profile'' as defined in WP2.1)

MODULES	BASIC KNOWLEDGE	• Definitions (soft skills, food industry, sustainability,bioeconomy)	• Job safety	• Digital learning/tools	• Basic of economic and financial issues	• English reading/understanding	• Business-/Entrepreneurship skills in general	• Knowledge of agri-food communities	BUSINESS PLANNING/MODEL	• Innovation management and its deployment	• Project management	• Decision making	• Time management	• Business planning	• Sales and Marketing	• Cooperatives	• Agri-food law, quality, safety and certification	SOCIAL AND COMMUNICATION	• Public speaking	• Negotiation and conflicts	• Food chain cooperation	• Staff working/networking	• Reporting and briefing	THINKING	• Organisation, planning, proactive, flexible, and strategic thinking	• Problem solving	• Interdisciplinary knowledge	• Learning Continuously	• Analytical, critical and creative thinking
FOOD SAFETY AND QUALITY				X		X						X	X				X			X	X	X	X		X	X	X	X	X
PRODUCTION OPERATIONS			X	X	X	X				X		X	X							X		X	X		X	X	X	X	X
PRODUCT DEVELOPMENT AND PACKAGING				X	X	X	X	X		X	X		X		X		X		X		X	X	X		X	X	X	X	X
SUSTAINABILITY		X		X				X								X	X				X					X	X	X	X
BIOECONOMY		X		X	X	X	X				X			X	X	X	X				X		X			X	X	X	X
REGULATIONS		X		X			X	X		X	X	X				X	X				X	X	X			X	X	X	

Annex 4b AERES – Modules for Technician Sustainable Agriculture profile

Question 1,2,3,12

Essential skills (black) and knowledge (blue) grouped in training modules.

Technician for Sustainable Agriculture + Concerned sector

1. Training modules	2. Key management / entrepreneurial skills	3. Practices 12. Online suitability
Soft skills; ICT Essentials: core digital skills; Job safety: Safety of workers and health, Health and safety management		Suitable for online training
Soil health management Crop rotation and new crop technics Integrated pest and disease management Good agricultural practices: Crop diversification; conservation farming; Smart farming introductory aspects (relation to the Digitalisation OP) Soil nutrients and fertility	Innovation management and its Deployment Agri-food law, quality, safety and certification	Practice most important Practice most important: Apprenticeship to learn the workfield and gain hands-on experience. Because the training module is broad, there is also need for excursions, demonstrations and lectures by people with hands-on experience in the field.
Water/groundwater management Legislation regarding the issue of water; Protected Area; Sustainable Land Use		Excursions / demonstrations Partly Suitable for online training
Adaptation and Mitigation to climate change Agro environmental practices Agroforestry; Biodiversity; crop protection; Grassland Management Environmental management aspects; GHG's emission reduction; climate change Measures and regulatory framework; Environmental Licensing	Innovation management and its deployment	Excursions / demonstrations
Efficient use of resources; Waste prevention and valorisation of by-products Circular economy: Traceability and Life cycle assessment aspects	Innovation management and its Deployment	Some practice important to create a 'feel' of the work field Partly Suitable for online training
Low Emission Spreading/Spraying Equipment and practices		Practice important
Sustainable feed sources and animal nutrition (sustainable sourcing, reducing emissions)	Food chain cooperation	Excursions to experimental farms important.
Energy management: energy efficiency; renewable energy	Innovation management and its deployment	Excursions / demonstrations Partly Suitable for online training
Work/Life Balance		

Annex 5 CEDEFOP - overview indicators

https://www.cedefop.europa.eu/fi/data-insights/indicator-overviews

Table of indicators

01. Students participating in IVET
02. Students participating in work-based IVET
03. IVET students with direct access to tertiary education
04. Employees participating in CVT courses
05. Employees participating in on-the-job training
06. Adults participating in education and training
07. Enterprises providing training to workers
08. Female students participating in IVET
09. Employees of small firms participating in CVT courses
10. Young IVET graduates continuing in education and training
11. Older adults participating in education and training
12. Low-educated adults participating in education and training
13. Unemployed adults participating in education and training
14. Adults wanted to participate in lifelong learning but did not
15. Job-related non-formal education and training
16. IVET public expenditure (% of GDP)
17. IVET public expenditure per student (PPS units)
18. Enterprises expenditure on CVT courses
19. Average number of foreign languages learned in IVET
20. STEM graduates from upper secondary IVET
21. Young people with a VET qualification at tertiary level
22. Innovative enterprises with supportive training practices
23. Employment rate for IVET graduates (20-34 years olds)
24. Employment premium for IVET graduates (over general stream)
25. Employment premium for IVET graduates (over low educated)
26. Workers helped to improve their work by training
27. Workers with skills matched to do their duties
28. Early leavers from education and training
29. 30-34 years old with tertiary attainment
30. NEET rate for 18-24 years olds
31. Unemployment rate for 20-34 years olds
32. Employment rate of recent graduates
33. Adults with low level of education
34. Employment rate for 20-64 years olds
35. Employment rate for 20-64 years olds with low level of education

36. Medium/high qualified employment in 2025