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Digitalisation of Sustainable
Health Education



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EMPLOYERS' NEEDS IN THE FOOD SECTOR - A EUROPEAN STUDY

**SKILLS
REQUIRED**

AN EU ERASMUS+ FUNDED
PROJECT TO DIGITALLY
UPSKILL VET EDUCATORS
AND TRANSFORM FOOD AND
HEALTH EDUCATION TO
MEET SUSTAINABILITY AND
LABOUR MARKET NEEDS.



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Introduction

The food industry is undergoing a transformative shift driven by the forces of digitalisation and sustainable development. With advancements in technology reshaping every aspect of food production, processing and distribution, the sector is increasingly relying on digital tools and innovations to enhance efficiency, transparency, and sustainability. As consumer preferences shift towards healthier, environmentally conscious options, the pressure to integrate sustainable practices into all stages of food production intensifies. The need for food companies to adopt digital solutions to improve traceability, reduce waste, and optimize resources is becoming critical. The European Union's "Farm to Fork" strategy, as part of the European Green Deal, underscores the importance of these transitions by setting ambitious goals for sustainability, such as reducing waste, promoting sustainable farming, and enhancing food safety⁽¹⁾.

Parallel to this transformation is the rising demand for a workforce that possesses modern skills. Prospective employees are expected to not only have proficiency in digital technologies but also an understanding of sustainability principles, policies and current practices. This dual requirement – digital competency and sustainability knowledge – presents both opportunities and challenges for the food industry's workforce development. To address this, the European Commission has stressed the need for upskilling and reskilling in the "Digital Education Action Plan", which promotes the integration of digital competencies across all sectors, including the food industry⁽²⁾. As a result, it is crucial focus on education programmes to adapt and align their teaching and training programmes to evolve with the needs of industry to ensure that future employees are equipped to navigate these changes effectively. Furthermore, the European Union's "New Skills Agenda for Europe" emphasises the necessity of equipping workers with the requisite skills to adapt to emerging technologies, sustainable practices, and digital transformation⁽³⁾. This agenda promotes enhanced Vocational Education and Training (VET) systems that effectively address the swiftly evolving requirements of industries, especially food and agriculture.

The aim of this report is to provide a comprehensive overview and insight into the expectations and requirements of the modern food industry labour market in Europe, as it pertains to the digital competencies of employees, awareness of sustainability, and the industry's sustainable priorities. This research will serve as the foundation for essential modifications to VET food and health education programmes to ensure that graduates fulfil job requirements.

Methodology

Study Design

This study involved both the use of focus groups and online questionnaire to explore employers' views and opinions on required skills and knowledge of future employees, and industry's

sustainable priorities. The use of both focus group discussions and online questionnaire with employers aimed to ensure that a wide representation of food businesses and employers across the project partner countries. This was done to ensure a representative sample of participants were involved. The online surveys provided an opportunity for those who could not participate in the focus groups to contribute to the project.

The focus groups and questionnaires were employed to assess the skills and knowledge requirements that employers seek in their workforce to effectively navigate the digital era and contribute to the achievement of the Sustainable Development Goals (SDGs), particularly in addressing the climate and food crises. Understanding these employer needs is crucial in determining how VET programmes in the food and health sectors can align with industry expectations. This alignment will help educators better equip learners and ensure that graduates are qualified and prepared for entry into the modern labour market. Both research approaches included inquiries regarding the digital and sustainable competencies that employers deem essential for their workforce. Furthermore, they sought employers' perspectives on how well graduates are currently prepared to meet the demands of the contemporary workforce and identified any gaps in VET programmes that must be addressed to enhance graduate employability. Additional questions explored which sustainable practices are prioritized by businesses and organisations, as well as the strategies they intend to implement in order to achieve these sustainable food practices (see Appendices 1 and 2).

Focus Groups

Researchers aimed to recruit 40 participants across the four countries (Ireland, Cyprus, Poland, and Lithuania) from diverse employment roles in the food industry sector, who had experience employing or supervising incoming graduates. Participants were initially recruited via promotional posts on social media including Twitter and LinkedIn, and then to support the achievement of maximum variation, eligible individuals were contacted via email or personal LinkedIn messages. Those interested were prompted to complete a consent form were and assigned to a focus group.

A semi-structured interview guide was used to guide the focus group discussions with

Discussions were conducted online via MS Teams under the guidance of a moderator and observer. In-depth, semi-structured, audio-recorded focus groups were conducted online by the lead researcher in Poland, Lithuania and Ireland using Microsoft Teams and lasted between 40 to 50 minutes ($M = 47.16$ min, $SD = 12.01$ min). Each partner country conducted its own focus group discussions, which were then transcribed and forwarded to the lead research team for thematic analysis. The interview schedule as outlined in Table 2 was broad covering how prepared they believed students were entering into the workforce upon graduation, digital competency levels expected in today's graduates, and food sustainability practice and priorities. Data from these questions were separated and thematically analysed for this study. All data was anonymised, and each participant was given a unique identifier code.

Online Questionnaire

The questionnaire was designed and circulated using MS Forms. Participants were eligible to complete the questionnaire if they were currently employed in a company in the food sector.

The survey was published online via social networks (LinkedIn, Instagram, Facebook etc.) and by sending questionnaires directly to companies via email. Participants were selected at random on LinkedIn and sent direct messages to encourage participation in the online questionnaire also.

Data Analysis

Both the focus groups transcripts and online questionnaires underwent content analysis. The aim was to transcribe the information in a way that did not alter the information content. All data analysed was de-personalised, with each participant given a unique code. Following the cleaning of the complete dataset, we familiarised ourselves with the data and created initial codes, which identified significant text from the focus group and survey responses. The coding process focused on identifying noteworthy elements within the data and conversations were held within the research team to settle any disagreements over interpretation until an agreement was reached. The final stage involved doing a comprehensive analysis of the data extracts associated with each theme, which provided answers to the study questions.

Results

Characteristics of Participants

Twenty-four participants took part in the focus groups. The participants were all working in the agri-food entrepreneurial community and included both men and women in various positions in the companies, from top managers to general employees. All participants were adults over 18 years old. Data was collected from three countries: Ireland, Lithuania, and Poland (Table 1).

Table 1. Characteristics of participants in focus groups. Participants are separated by unique, assigned participant codes, accompanied by their job title or place of work, and country of work (Compiled by Authors, 2023)

Focus group participant code	Job title or organization	Country
P001	CEO	Ireland
P002	Sustainability lead	Ireland
P003	Site production manager	Ireland
P004	Senior general manager	Ireland
P005	Senior global nutrition monitor	Ireland
P006	Head of regulatory affairs	Ireland
A001	KFC- KFC's (Kentucky Fried Chicken)	Poland
A002	Seller in a local grocery shop Lux Mini	Poland
A003	Staff member of Zakład Mięсны Podgórze	Poland
A004	Staff member Cukiernia Rafaello	Poland
A005	Staff member of Spokojna restaurant	Poland
A006	Zakład spożywczy Bona	Poland
A007	Sulima Piekarnia	Poland
A008	Waitress of the Black Sheep restaurant	Poland
A009	Lab worker in OSM Piątница	Poland
A010	Production worker in Sękacz Piątница	Poland
I001	Personnel Manager	Lithuania
I002	Consultant Technologist	Lithuania

I003	Technologist	Lithuania
I004	Commercial Director	Lithuania
I005	Production Floor Manager	Lithuania
I006	Production Manager	Lithuania
I007	Quality and delivery manager	Lithuania
I008	Director	Lithuania

Accordingly, online questionnaire participants also consisted of those from the agri-food entrepreneurial community, both men and women in various positions in a variety of companies. All participants were adults and data was collected from four countries: Ireland, Lithuania, Poland and Cyprus, with one additional response from the USA. The total number of participants in the questionnaires was 84 (Table 2).

Table 2. Characteristics of participants in questionnaire. Participants are separated by unique, assigned participant codes, accompanied by their job title or place of work, their gender, and country of work (Compiled by Authors, 2023)

Questionnaire participant code	Type of food industry organisation/institution	Gender	Country
I15	Compass Group	Female	Ireland
I16	The little coffee co	Male	Ireland
I17	Noo Chocolates	Female	Ireland
I18	Compass Group Ireland	Male	Ireland
I19	Ornua	Female	Ireland
I20	Compass Group	Female	Ireland
I21	Murray Meadows	Female	Ireland
I22	Compass Group	Female	Ireland
I23	Compass	Male	Ireland
I24	Compass Ireland	Male	Ireland
I25	ATU	Female	Ireland
P26	Sery Korycińskie	Female	Poland
P27	Black Sheep restaurant	Male	Poland
P28	Ser Koryciński	Female	Poland
P29	KFC restaurant	Male	Poland
I30	Juice Genie	Female	Ireland
P31	Agroturystyka Malinówka	Male	Poland
P32	Na Farnej Restaurant	Female	Poland
P33	Cukiernia Rafaello	Female	Poland
P34	Cukiernia Rafaello	Male	Poland
P35	Na Farnej Restaurant	Female	Poland
P36	J.Ż. Agricultural Enterprise	Male	Poland
P37	KFC	Male	Poland
P38	Omega food wholesale	Male	Poland
P39	Cardinal Stefan Wyszynski Regional Hospital in Lomza	Female	Poland
P40	OSM Piatnica	Female	Poland
I42	North Cork Creameries Ltd.	Male	Ireland
P43	Horeco Sp. Z o. o.	Female	Poland
I44	Nutritics	Male	Ireland
I45	Nutritics	Female	Ireland
P46	COLNUS Hotel and Restaurant	Male	Poland
P47	Cardinal Stefan Wyszynski Regional Hospital in Lomza	Female	Poland
P48	RETRO	Female	Poland
P49	MOHITO B&B	Male	Poland
P50	Żabka	Female	Poland
P51	Vitaline	Female	Poland

P52	Biedronka	Male	Poland
P53	fruit and vegetable store	Male	Poland
P55	Veterinary and General Education School Complex No. 7	Female	Poland
P56	Veterinary and General Education School Complex No. 7	Female	Poland
P57	Primary School Number 1 in Łomża	Female	Poland
P58	Łomża State University of Applied Sciences	Female	Poland
P59	Horeco	Male	Poland
P60	COLNUS Hotel and Restaurant	Male	Poland
P61	FRANGOS	Male	Poland
U62	Aramark	Female	USA
I63	Kerry	Female	Ireland
L1	UAB "Mantinga"	Female	Lithuania
L2	Biržų duona	Male	Lithuania
L3	UAB "Žemaitijos pienas"	Female	Lithuania
L4	UAB Vilniaus duona	Female	Lithuania
L5	AB AUGA group	Male	Lithuania
L6	AB Vilkyškių pieninė	Female	Lithuania
L7	UAB "Kėdainių konservų fabrikas"	Female	Lithuania
L8	AB "Pieno žvaigždės"	Male	Lithuania
L9	Žiežmarių mėsa	Female	Lithuania
L10	Čekiškės ūkis "Senoviniai mėsos gaminiai"	Male	Lithuania
L11	Krekenavos agrofirma	Female	Lithuania
L12	UAB Green Factory Baltic	Male	Lithuania
L13	ECKES-GRANINI	Female	Lithuania
L14	"Dvaro konditerija"	Female	Lithuania
L15	UAB "Bella Toskana"	Female	Lithuania
L16	UAB Eurocrickets	Male	Lithuania
L17	UAB Samsonas	Male	Lithuania
L18	UAB Majonezas „Vilnius“	Female	Lithuania
L19	UAB „Naujasis Nevėžis“	Female	Lithuania
L20	Vičiūnai ir Ko	Female	Lithuania
L21	Kadaginė	Female	Lithuania
L22	UAB Daržulis	Male	Lithuania
L23	UAB Malsena plus	Female	Lithuania
L24	Žemės ūkio kooperatyvas "Pienas LT"	Male	Lithuania
L25	UAB Lietuvos kepėjas	-	Lithuania
L26	UAB Fazer Lietuva	Male	Lithuania
L27	Rokiškio Mėsinė	Male	Lithuania
L28	UAB "Rokiškio sūris"	Female	Lithuania
L29	UAB Kietaviškių gausa	Male	Lithuania
L30	Sauda	Female	Lithuania
C1	College	-	Cyprus
C2	Grigoriou B.E. Ltd	-	Cyprus
C3	KEAN SOFT DRINKS LTD (Ministry of safety, health and environment)	-	Cyprus
C4	KEAN SOFT DRINKS LTD (Food Safety and Quality Control Manager)	-	Cyprus
C5	TEPAK	-	Cyprus
C6	Iakovos Photiades Foodstuff Suppliers Ltd	-	Cyprus
C7	KEAN SOFT DRINKS LTD (Plant Manager)	-	Cyprus

Perception of Graduates' Preparedness

Through analysing the data investigating the number of food and health degree graduates employed in such companies, it became apparent that this figure is dependent on the size of the organisation and the type of food industry it is involved with. So, this number is not constant and can vary depending on the circumstances of the organisation.

Participants note that roles can vary widely depending on the type of food industry. The most frequently mentioned are listed below in Table 3. This analysis shows that graduates in the food industry can have widely differing roles depending on the organization they work for, such as food safety inspector, food scientist, nutritionist, and marketing specialist etc. Each role requires different skills and responsibilities, making it difficult to assess all roles possible to the same level of detail.

Table 3. Food and/or health graduate's roles within the food industry organization, separated by category then further into subcategory (Compiled by Authors, 2023)

Category	Subcategory
Roles in food industry organizations	Involvement in the development of new food products, recipes
	Applying new technological processes in production processes
	Control and analysis and improvement of existing products
	Preparation of product specifications (cost, technological, nutritional, and microbiological characteristics of products)
	Execution of the technological process of the products, control of yields
	Preparation of the workplace for the handling and processing product
	Working on production lines, checking that products are properly manufactured, adjusting production lines for new recipes
	Produce products
	Selecting, evaluating, and preparing raw materials for product production
	Production process monitoring, control, improvement
	Analysis and control of the production process, technological indicators
	Staff training
	Implementation and updating of food safety procedures in production units, food safety management systems
	Preparation and systematization of production technological documentation
	Quality supervision, recording of quality parameters
Production, organization marketing and sales	

This variation in resulting food industry employer roles can be partly explained by the fact that the food industry is complex, involving several stakeholders, including farmers, processing plants, retailers, and consumers etc.: *“Those roles can be very different depending on the position, you would probably have to ask specifically what the position is and then I could tell you about the roles of that position. For example, our most common positions are food technologist <...>. You will need to work on production lines, checking that products are properly manufactured, adjusting production lines for new recipes, developing new recipes”* (I007) In addition to this, organisations may have their own methods for assessing graduate roles. Therefore, measuring graduates' roles in food industry organizations requires a tailored approach that considers the specific nature of the organization and the graduates' particular role.

The results of the vacancies promotion are very similar across the four countries. The most common responses can be seen in Figure 1.



Figure 1. The most common responses to how organizations promote the advertisement of job vacancies. (Compiled by Authors, 2023)

This is also confirmed by respondent I008, who says that *“We use a wide variety of channels, posting ads on our website and social pages, as well as looking for employees through direct contact, for example at fairs. Sometimes we also use traditional advertising channels”*.

Almost all participants indicated that higher or vocational education in food or health field is required. A small proportion mentioned that secondary education is enough or that they do not have any qualification requirements as they can train the candidates themselves. The results of the focus groups interview and questionnaire surveys complement each other, the qualification requirement depends on the job position: *“<...> kind of set structures or levels and there would be prerequisites for each of those. <...> depending on what you're going for”* (P002). Hence, evaluating candidates' qualifications may vary depending on individual organizations needs and requirements: *“Depending on the job, higher positions require a university degree. For lower positions, a secondary education is sufficient.”* (L11). Therefore, there is no standardized method to measure graduates' qualifications, making it difficult to compare skills and knowledge levels.

The survey reveals the most common training methods used to train new recruits. Table 4 below summarizes the results.

Table 4. Training methods for new position (Compiled by Authors, 2023)

Category	Subcategory
Training methods for new position	General one-day induction (health and safety and quality inductions to site, general information about organization, internal procedures, company culture and regulations)
	On the job, workplace training
	Distance training, online courses, modules, seminars
	Traditional courses on a variety of topics
	Designation of an instructor, mentor, trainer, one-on-one training
	Job shadowing
	Long training programme on general organisational activities and specific job tasks

It was also noted by participants that the format and topics of training can vary widely, depending on the job position and the company's internal standards: “<...> *very specific to where they are*” (P004). Based on this survey, a table of key training aspects and themes in the workplace has been drawn up. (Table 5)

Table 5. Key aspects of the training content given to employees in in food industry businesses, separated by category and further separated into subcategory (Compiled by Authors, 2023)

Category	Subcategory
Training aspects for new position	Presentation of products, production lines
	General introduction to the workplace, procedures
	Safety and health, safety compliance training
	Training on how to behave at work
	Training on direct job functions, rules, processes
	Training in technical skills for quality assurance
	Understanding of logistics requirements and process management skills
	Workplace preparation, cleaning training
	Familiarization with technological equipment, tools, and facilities
	Introduction to the use of internal automated systems
	Training of product packaging, labelling
	Preparation of raw materials and auxiliary materials for production
	Introduction of basic customer service rules
	Time management training
	Order and payment system training
	Training in the management of the online ordering system and order management software
	Food safety training
	Cooking lessons and courses
	Employee engagement training
	Training in the use of specific software
Sustainability training	
Lab training	
Allergen awareness training	
Handling food data and food information	

The food industry is constantly evolving, with new technologies, regulations and trends constantly emerging. This is evident from the following example “<...> *often professional skills are not enough, because here they see modernised working tools, new technologies, so we train them to work with the equipment*” (L11). Graduates may have the necessary skills, but they may not be fully aware of the latest developments in the industry, which is why on the job training is mandatory.

Digital Competency

According to the survey participants, there is no consensus on whether graduates are adequately prepared for this age of digitalisation. The results can be partly explained by the fact that preparation depends on the job position and demands of digital skills requirements in the workforce. It also depends a lot on the graduate's personality and how quickly he or she can absorb new knowledge. According to P006 “<...> *graduates are coming out fairly well prepared and open and accepting of digital tools.*” Another participant P002 echoes this sentiment “<...> *they seem to be able to learn the systems <...>*”. However, there is a gap in the production environment,

as stated P003 *“I would say in terms of basic digital <...> yes computer literacy, yes <...> probably a gap in terms of like, particularly in production environments. <...> We would have a lot of like automated systems, HMI and particular apps that we would use, <...> to monitor different things on the production floor”*. The statement implies that some digital competences are only encountered when graduates enter the workforce, as production uses specific equipment.

According to the data provided, to succeed in the food industry, employees must be equipped with digital competencies such as knowledge of software programmes, computer systems, social media, and internet research. Employees must also be proficient in data analysis, digital marketing, and e-commerce. In addition, digital competencies are critical for managing food supply chains. Workers need to be able to use digital tools to manage inventory, track shipments, and monitor production processes. The data analysis is summarised in Table 6.

Table 6. **Digital capabilities expectation from employees listed as category and sub-categories (compiled by Authors, 2023)**

Category	Subcategory	n
Digital capabilities expectation from employees	Possession of social media management skills.	8
	Management of e-commerce platforms, website maintenance and design, digital marketing tools.	11
	Basic computer literacy (Microsoft or Google tools).	44
	Use and management of computerised production equipment, specialised software, specific office programs, administrative software application.	15
	Data analysis and interpretation, working with large amounts of information.	16
	Communicating using digital technologies, information sharing.	7
	Placing material orders using digital tools.	2
	Ability to use printers.	2
	Knowledge of basic data security and privacy, and netiquette.	4
	Understanding of digital tools and technologies that help reduce the environmental impact of agriculture.	2
	Awareness of digital technologies that can help ensure compliance with regulations related to food safety, traceability, and labelling.	1
	Basic programming skills, coding.	3
	Management of supply chain, including tracking products from farm to table. Monitoring inventory levels, optimizing logistics.	2
	Collecting, searching, and storing relevant information and digital content.	11
	Use and maintenance of production equipment used by the company.	3
	Digital order handling with digital programmes, knowledge of digital payment options.	7
	Continuous learning and adaptability, problem solving.	6
Skill in using mobile apps.	2	
Robotics, maintenance and management of IT capacity	2	

Most survey participants indicated that basic computer literacy skills are still needed and required. On the other hand, tasks requiring basic skills may decrease as machine automation increases, employees must know how to use computerised production equipment, specialised software, specific office programs, administrative software application. *“<...> if people who prefer to work <...> with cooking, maybe they have weaker technological skills. And the other part of the graduates who want to work more on the creative side, <...> the packaging rethinking, on the recipe side, they are more likely to have that kind of deeper knowledge. So it also depends on the type of person, whether they want to produce the product itself <...> to work more in production, or whether they want to create more and go into the technological side, then their*

knowledge is a bit deeper in the digital part.” (I001). It can be concluded that the digital competencies required also depend on the job position and personality.

Analysis of the data in the table shows that soft, social, and emotional skills are also in very high demand. Higher cognitive skills such as creativity, good communication, critical thinking, teamwork, problem-solving, decision-making, and lifelong learning are very important because soft skills directly linked to ability to master digital work tasks.

A small proportion of respondents indicated that rapidly changing technological equipment requires advanced demand for technological skills. These include both basic digital skills and advanced technological skills such as programming, and as participant L11 mentioned: *“There is always a shortage of good IT professionals, and in the future, all production processes will become even more digitalised, high-performance computers will be needed, artificial intelligence will emerge, and cyber-security will need to be implemented”*. Additionally, awareness of data security and data protection will gain more importance because of this demand. One participant (P006) reported that *“<...> increasing awareness around cyber security, <...> data protection law, <...> increasing awareness around data analytics and using analytic platforms to <...> make our draw conclusions from large data sets.”* As stated, due to the increasing automation and digitalisation of industrial processes, the workforce will be responsible for more complex tasks. The execution of those tasks will require numeracy, solid literacy, problem-solving, and information and communication technologies skills as well as soft skills of autonomy, collaboration, and coordination.

When asked whether graduates are meeting expectations, a large proportion of respondents answered positively, this can be explained by the fact that a large proportion of employers only require graduates to have basic digital skills, whereas advanced digital skills are learned on the workplace. *“I think to a certain degree <...> they get really good exposure to what we expect <...> and we do <...> provide internal training and then support any additional professional upskilling that <...> someone would like to take on.”* (P006). The other half of the participants believed that graduates don't always live up to expectations, students sometimes lack basic elementary knowledge and should have a broader understanding of digital competencies and how digitisation affects the food industry. *“I would still view that they should have particular, maybe not food science, but they should have an understanding of like the functionality of <...> automation maybe not to the obviously not to the level of an automation engineer, but an understanding of the role that they play within <...>”* (P003). In general, the job profiles will be demanded to carry out tasks with a much broader scope. Therefore, graduates will be expected to have a wider knowledge and expertise in several subjects.

According to the participants who took part in the survey, educational institutions can contribute to the development of digital competences in various training methods (7 table). Most respondents said that some digital competences can only be acquired in the workplace, which is why it was suggested that educational institutions should create learning environments that are as realistic as possible and similar to the workplace or offering work-based learning opportunities in workplace (apprenticeships). P33 *“Training programmes should provide hands-on experience with digital tools and technologies that are relevant to the agri-food industry.”* One participant was found to suggest the creation of a virtual learning environment. This is an excellent example of how educational institutions could mirror real working conditions. Therefore, it can be argued

that the best way to develop digital competencies is to put the skills that students learn into practice. Educational institutions need to look for real opportunities for students to put what they have learned into practice.

Table 7. Training methods that should be implemented to develop digital competences listed as category, sub-category and accompanying relevant statement. (Compiled by Authors, 2023)

Category	Subcategory	Affirmative statement
Training methods for developing digital competency	Offering work-based learning opportunities in workplace (apprenticeships)	L11 “It’s hard to see how they would train you to work with real factory equipment, the students would still have to go to a real workplace.” L15 “Vocational schools only provide the basics, but a lot of digital competences are only learned in the workplace, because not all vocational schools have the facilities.”
	Developing a digital competency-based learning programme	L5 “Maybe develop broader programmes, include more IT stuff.” LT9 “Just put more emphasis on digital competences in the curriculum.”
	Creating work-based learning environment in VET schools	L12 “To train more professionals to maintain production lines and modern technologies.”
	Virtual training	L28 “It has to be as realistic as possible, with production lines, so maybe some virtual training so you can see everything that actually happens in production.”
	Learning through traditional lectures	I17 “Would need to make sure that basic literacy skills aren’t lost while focusing on digital skills, social media posts still need to be well written, as do any communications via email etc.”
	Organisation of seminars and workshops	I007 “Educational institutions can organize workshops and seminars for their students to develop digital competency. These workshops can cover different topics related to digital skills and offer hands-on experience to students”
	Online courses and tutorials development	I008 “Maybe schools can use online courses and tutorials on various topics related to digital competency, such as coding, data analysis, web design, social media marketing, etc.”

It should also be emphasised that digital competency is ever-evolving, thus, it’s essential to stay up to date with the latest developments in digital technology by attending seminars, workshops, online courses and tutorials, creating advanced courses or digital competency-based learning programmes. “Just to encourage and say that the more digital everything becomes, the more new technologies emerge, education has to move with and keep up with innovation.” (L22). As can be seen from the above statement, a very important aspect is the continuous and regular communication with employers to understand the digital skills and knowledge needed in the industry.

It is clear that the majority of the survey participants do not have a very clear view on the need for digital competences and the specific areas of digital competences that could be developed in an educational institution. However, basic computer skills, digital communication, data analysis, web development, software training or social media management were very often suggested (8 table).

Table *. Training subjects that should be implemented to develop digital competences listed as category and sub-categories. (Compiled by Authors, 2023)

Category	Subcategory	n
	Basic computer literacy (Microsoft or Google tools)	19
	Data analysis and interpretation, basic training with Database	12

Training subjects for developing digital competency	IT training	9
	Software training	14
	Basic programming skills, coding	4
	Digital content creation and Web Design	6
	Digital citizenship, network etiquette	5
	Digital marketing training, e-commerce	5
	Operating and marketing on social media and engaging customer online	5
	Proficiency in the use of digital tools and technologies	10
	Continuous learning and adaptability, problem solving, communication (soft skills)	7
Understanding of digital tools and technologies that help reduce the environmental impact of agriculture.	1	

In addition to technical skills, training programmes should also focus on developing soft skills such as collaboration, communication, and critical thinking. These skills are essential for effective teamwork and decision-making in a digital environment “<...> digitalisation is also an important part of the job, maybe in this place you need to be quick to react, to be able to grasp things quickly” (L19). It is also worth mentioning the P33 participant’s opinion on sustainability: “Training programmes should highlight digital tools and technologies that can help reduce the environmental impact of agriculture, such as water conservation, energy efficiency, and waste reduction.”. With increasing digitalization, the knowledge and skills needed to navigate the online world safely and responsibly, including issues related to privacy, security, and online behaviour must be included in the training programmes.

Sustainability

The analysis of the responses to online questionnaire question about the concept of sustainability understanding showed that the majority of the participants in the survey perceived sustainability as protecting the environment and reducing climate change (9 Table). A large proportion of the responses relate to healthy, quality, organic products, rational use of resources and reducing waste. Some respondents also felt that sustainability “is a development in which the needs of the present generation can be met without diminishing the chances of future generations to meet them.” (P26).

Table 9. Understanding the concept of sustainability in the food industry listed as category, sub-category and accompanying relevant statement. (Compiled by Authors, 2023)

Category	Subcategory	Affirmative statement	n
Understanding of the term sustainability	Protecting the environment, reducing negative environmental impacts	I17 “Operating in a manner that does not cause harm to the environment <...>”	22
	Reducing climate change and climate warming, air pollution	L16 “When irresponsible human activity causes climate change, a global food threat. <...>.”	12
	Use of healthy, safe, high-quality, organic products	L26 “<...> is a food experience company that wants to change the world. We see food as one of the solutions. How we grow, use and ultimately produce food has a profound impact on the environment, society and the well-being of people and the planet as a whole.”	20

Reducing the carbon, negative footprint of production activities	I24 “To me it’s about day-to-day activities in order to reduce carbon footprint <...>”	4
Ensuring public health (society and staff)	L23 “It is a multifaceted commitment to a better quality of life for all. Economic development, social development, and environmental protection <...>”	5
Use of renewable resources	P40 “I see sustainability as using natural resources with respect to nature and caring for it.”	2
Waste reduction	L15 “It’s a complex concept, I don’t associate it with ecology, maybe more with the waste reduction.”	13
Recycling	I22 “Use renewable resources, be seasonal, reuse and recycle where possible”	2
Rational use of resources	I16 “A process that’s circular or requires no external inputs.”	13
Ensuring a stable and secure future for the next generations	I23 “Sustainability consists of fulfilling the needs of current generations without compromising the needs of future generations, while ensuring a balance between economic growth, environmental care and social well-being”	12
Balanced development (economic, social)	C2 “As a way of operating the business, which minimizes the consumption of natural resources and the burden on the environment and at the same time is efficient, safe and economical for the business itself.	16

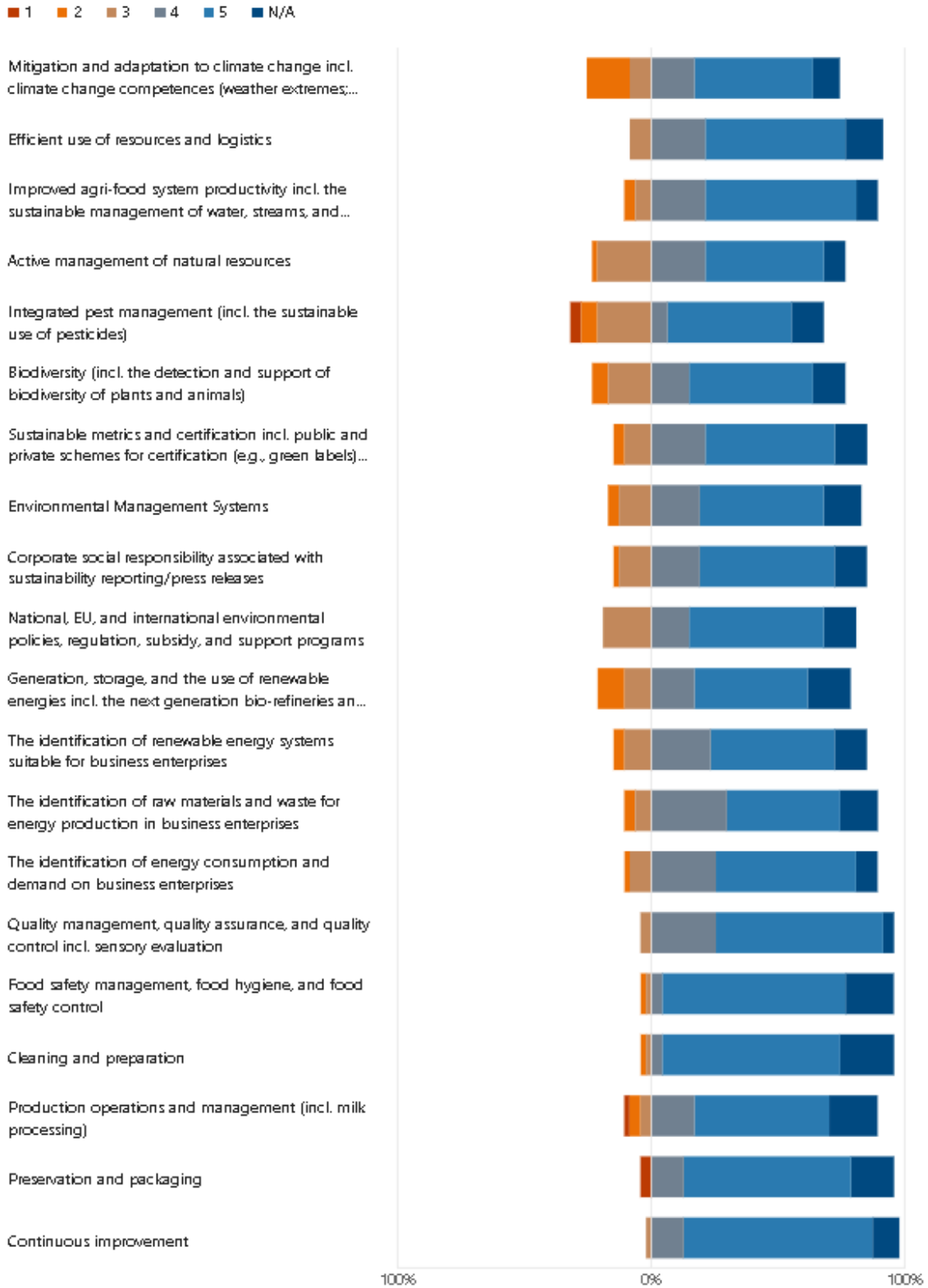


Figure 2. **Importance of sustainability competences in Poland and Ireland agri-food entrepreneurial community and organisations.**

It can be stated that there is no single common understanding of the concept of sustainability. The analysis of the responses shows that it can encompass strategies and practices that protect natural resources, reduce waste and pollution, promote social justice, and support economic growth.

Based on the data presented in Figure 2 on the importance of sustainability competences in Poland and Ireland agri-food entrepreneurial community and organisations, it can be argued that the majority of companies pay attention to the competences listed in Figure 2.

It can be argued that taking these sustainability competences into account can help to reduce the carbon footprint from sourcing ingredients to packaging and manufacturing. Sustainability competencies are essential in ensuring that food industry organizations are operating in a socially responsible manner. By reducing waste, optimizing resource use, and operating efficiently, companies can save money and improve their bottom line. Companies that demonstrate a commitment to sustainability can benefit from improved environmental, social, and economic outcomes, as well as a competitive advantage in the market.

The results clearly indicate that majority of the companies surveyed have sustainability policy for practice. A smaller proportion do not have sustainability policy for practice, but as stated by participant I23 some companies are moving towards setting sustainability policies for practice and will develop them in the future: *“Identifying departments for change and implementing processes for change”*.

Table 10 shows companies' sustainability priorities and examples of how they are working towards these sustainable food practice goals.

Table 10. Sustainability priorities and sustainable food practice goals with accompanying relevant statement (Compiled by Authors, 2023)

Company's sustainability priorities	n	Examples of achieving sustainable food practice goals
Net Zero, zero carbon emissions	9	<p><...> has launched the first technology for a "green" food chain - a climate-friendly tractor. (L6)</p> <p>Implementing pollution prevention measures (P39)</p> <p><...> we have actually released a module that supports the food industry with reporting and tracking of their scope, 3 emissions. So that's a module called food print, which enables food businesses to have I guess transparency over the food supply chain that they use. (P006)</p> <p><...> figuring out what our baseline is and then I think that is going to guide the actions that we take to implement you know and whatever it is we need to do to reach those net zero goals (P006)</p>
Reducing CO2 emissions	6	<p>The company is also developing other sustainable innovations: emission-reducing feed technologies and a sustainable crop production system. (L6)</p> <p><...> taking a number of measures to reduce CO2 emissions associated with food transportation and storage, such as by upgrading refrigeration systems and using energy-efficient technologies. (P52)</p>
Improve the management of energy and other resources, energy saving	21	<p>We will aim to reduce energy and water use by 10% over the next 5 years (compared to 2022 levels). (L1)</p> <p>we use the clean solar energy generated by our power plant, and we capture the heat from the ovens during baking and use it to heat the bread-making processes, water, and office space. (L2)</p> <p>We have a solar power plant and produce green energy. (L11)</p> <p>We have started using our own biofuel boiler house. We collect rainwater, using gutters to collect rainwater from the roofs of our greenhouses into a rainwater catchment on the site, which is then used to irrigate vegetables. (L29)</p>

		<p>We have a policy to conserve energy and reduce waste as much as possible (e.g., be reusing boxes, making larger batches to reduce the amount of time machines are operating, only heating as much water as is required) (I17)</p> <p>The group has a centralised method for sustainability related capital investment and has invested heavily in energy management systems in the last number of years to support this. (I19)</p> <p><...> using energy-efficient appliances and equipment in its restaurants and offices. (P37)</p> <p><...> by using energy-efficient lighting, heating, or air conditioning systems, and using rainwater to water plants (P39)</p> <p><..> we have our own sustainable electric power plant, water intake and sewage treatment plant. All of these facilities work with maximum efficiency to provide sustainable resource management. (P40)</p> <p>Using energy-efficient lighting, refrigeration, and heating systems, and using renewable energy. (P50)</p> <p>Through Regenerative Farming Practices (I21)</p> <p>Use of renewable energy sources <...> (C4)</p> <p><...>conscious electricity saving, equipment is bought that saves electricity, cars are hybrid (I002)</p>
Continuous improvement of production technology and products	11	<p>We continuously invest in modernising our production lines to produce better products. (L7)</p> <p>We are developing new technologies, one of the latest "creations" is a sowing machine and a personal innovative lighting system for plant cultivation, which has been tested and perfected for years. (L22)</p> <p>Our greenhouses are equipped with the latest technological equipment, modern lighting and a microclimate support system. (L29)</p> <p>Invest in new technologies (C7)</p>
	21	<p>We encourage customers to bring their own cups and bowls. (L2)</p> <p>To educate and train the company's employees by continuously improving their qualifications, awareness, and consciousness (L8)</p> <p><...> training and auditing farms and farmers (L13)</p> <p><...> in our communication we aim to make people aware of the benefits of crickets and sustainable food for the future. (L16)</p> <p>Introducing a sustainability policy, <...>, raising employees' awareness of sustainability. (L24)</p> <p>At a site level this looks like metering, reporting and trending of same to root cause and problem solve over consumption. (I19)</p> <p>Providing training to new employees (P27)</p> <p>Our focus is on helping food suppliers and food businesses strive to be better informed as to the sustainability of their food, menus, and suppliers (I44)</p> <p>Offering a wide range of vegetarian and vegan products and promoting a plant-based diet that is more sustainable for the environment. Providing information about the origin and composition of products so that customers can make more informed choices. (P50)</p> <p>As part of its "Healthy in Sport" programme, <...> organizes campaigns to promote physical activity and healthy eating. <...> runs social programmes that include outreach to the needy, support for local nonprofit organizations, and education on sustainable lifestyles and healthy eating. (P52)</p> <p><...> 50/50 gender in senior management (P002)</p> <p><...> depends not only on the educational institution, but also on the family when it comes to waste sorting (I005)</p>
Possession of the Sustainable Brand Index	3	<p>Our company's certificates confirm that we produce quality products in accordance with the highest international standards for food production. (L11)</p> <p>An integrated quality, food safety and environmental management system is in place, complying with ISO 9001, ISO 14001, BRCGS Food Safety, Halal, RA and Fairtrade requirements. (L19)</p>
Producing high quality and safe products	34	<p>strive to ensure that all the cocoa used in our products is responsibly sourced and certified by UTZ or RFA (Rainforest Alliance). (L1)</p> <p>We have done away with caged chicken eggs. (L2)</p> <p>We do not use flavour enhancers, preservatives where possible or artificial colours. (L7)</p> <p>We are completely free of chemical preservatives and dyes, health-threatening substitutes, and additives (L9)</p> <p>We work only with the most reliable suppliers of raw materials. (L9)</p>

		<p>We choose quality raw materials, produce properly, and ensure food safety and hygiene. (L10)</p> <p>We have a self-monitoring system in place to check production processes, raw materials, and recipes during internal audits. (L11)</p> <p>We carry out both external and internal audits. <...> Strict food safety requirements and compliance with them guarantee a safe food preparation process and appropriate storage conditions for the finished products. (L12)</p> <p>We use fresh and natural products. (L14)</p> <p>Food safety and quality standards are in place and the system is regularly audited by three independent auditors. (L28)</p> <p><...> ethical sourcing of ingredients and materials, such as using fair trade or organic products. (P29)</p> <p>We always check the composition of goods, and their certifications, before we buy. (P48)</p> <p><...> selling ingredients that are basically coming under a healthier criterion. (P002)</p> <p><...> when it comes to animal derived ingredients like e.g. friends of the sea certification is required for our marine oil (P005)</p> <p>Quality management, quality assurance and quality control (C6)</p>
Promoting organic and local products, business	10	<p>Our vegetable and fruit products are made from ingredients that have been carefully selected and sun-ripened, grown specifically for us in a natural environment. (L7)</p> <p>All products are made only from fresh, selected Lithuanian raw materials and the production process is controlled for each product (L21)</p> <p>Our company sources almost all of our packaging in Ireland. We use local food products where possible (except chocolate, sugar, vanilla, and similar products not produced in Ireland). (I17)</p> <p>Sourcing locally and seasonally (I22)</p> <p>Through sourcing food locally produced over imported goods when available, engaging in growing for ourselves when possible <...> (I30)</p> <p>Using local products and implementing effective methods in the kitchen. (P35)</p> <p>We buy products from local suppliers. (P49)</p> <p>Promoting organic and local products that reduce greenhouse gas emissions and support the local economy. (P50)</p>
Waste management and rationalisation	20	<p><...> reduce the amount of disposable packaging per tonne of production by at least 5% over the next 5 years (from 2022). (L1)</p> <p>We conserve food by crumbling off-brand loaves into sourdough starter or creating other products from them. (L3)</p> <p>Identifying departments for change and implementing processes for change (I23)</p> <p>Agri-food companies can work to reduce food waste by implementing practices such as improved inventory management, donating surplus food to charity, and repurposing food waste for animal feed or fertilizer. (P34)</p> <p><...>implementing waste reduction strategies such as recycling, composting, and reducing packaging waste. (P37)</p> <p>Reducing food waste through better inventory management, reducing packaging and offering products with extended shelf life. (P50)</p> <p><...> conversations with the with the sales team, with the retailer's big piece around best before used by dates. (P001)</p> <p>Food is donated to the food bank, the one that is still valid, animals <...> (I002)</p>
Use of recycled and biodegradable materials	19	<p>Our packaging is 100% recyclable (L14)</p> <p>We are reducing our plastic consumption and trying to recycle as much as possible (L26)</p> <p><...>using sustainable packaging materials, such as biodegradable or recyclable materials <...> (P29)</p> <p>Using biodegradable packaging for customers ordering a take-out, using paper towels and napkins from recycled materials and informing our clients about it. (P32)</p> <p><...> packaging is also moving away from plastic to recyclable paper (I002)</p>
Sustainable sourcing	3	<p><...> source its food ingredients from sustainable sources that use environmentally friendly and socially responsible practices (P37)</p> <p>Sourcing raw materials and direct inputs from certified suppliers. (I42)</p> <p>We always check our suppliers. (P43)</p>
Protection of animals and forests	3	<p><...> our supplier, we have to get like certain certificates around you know animal husbandry and then like deforestation. <...> promote more plant based formulas when it comes to food, because you know that's healthier for people and also the planet. (P005)</p>

Promote a culture of food safety, sustainable business principles and contribute to the long-term conservation and sustainable use of marine living resources. ISO, BRC, IFS Food, IFS Logistics, MSC, FSSC 22000, ASC, Global Gap. (L21)
We are joining the Empty Cages initiative to replace all eggs used with eggs from "Lucky" hens (L1)

An analysis of the data in the 10 table shows that companies are actively pursuing sustainability goals and implementing various initiatives. These practices help to reduce the impact of human activities on the environment and preserve natural resources for future generations. Moreover, these sustainability practices help to generate long-term economic benefits by reducing the costs associated with waste reduction, energy-efficient, enterprise projects and innovative production and recycling technologies. It also ensures the well-being of people and communities.

The focus group discussion provided an opportunity to see a slightly broader picture of sustainability. Sustainability requires a balance among environmental, economic, and social concerns, and these three factors tend to compete with each other. For example, it could be the opinion of participants P001 “<...> *it does have to be about making money. <...> there was a certain yogurt that was launched that was fully sustainable, no added sugar; B corporate credited, fully recyclable and it absolutely bombed because it tastes like muck. So that's the trade-off. It's all lovely, but will people pay for it if it doesn't taste good? I mean, people love the sustainability story. <...> but are they prepared to put their hands in their pocket and what the company will ultimately make, that'll be the deciding factor.*” It can therefore be argued that economic development often leads to environmental pollution and social inequalities, while environmental protection efforts can undermine economic growth and social well-being.

Additionally, another example is the opinion of participant P003 “<...> *point like in terms of like false sustainability <...> we manufacture butter <...> butter by nature is obviously fatty. It's an oily based product whatever you wrap it in naturally absorbs the outer layer of fat and oil. And yes, you would get you know in terms of from like sustainability point of view, there's a push within we'll say the dairy industry to move towards sustainable packaging, when in reality like <...> you still can't recycle it. <...> There's probably that piece as well in the sense of there's a lot of sustainability initiatives that are not, it's a ticked the box as such like which is the same thing as the business element piece to it like that, it's just not feasible like beyond the paperwork like.*” Such example show that sustainability is a long-term and complex concept that requires systemic changes, behavioural modifications, and technological innovations, which entails overcoming various barriers and challenges.

An analysis of the responses to the questions on graduates' knowledge and understanding of food sustainability and whether this knowledge is relevant to the needs of the labour market shows that there is no consensus. A smaller proportion of survey participants state that graduates meet the expectations or show a clear desire to understand sustainability importance “<...> *person had a good understanding of the impact of supporting local, and the dangers in sourcing products from areas where quality control and food safety practises may not be as strong as Ireland.*” (I17) “<...> *it's such a hot topic <...> and graduates <...> They are interested. They are eager to understand. They're eager to get involved. They're eager to learn about it and <...> see how or what they can do to, <...> just support, <...> the whole drive for us to just be better, <...> around climate, around food supply chain, around all of that.*” (P006)

Another half of participants considered that graduates' knowledge was adequate, but only partially: *“The answer to this question is difficult because it depends on the specific curriculum and approach to the topic of food sustainability. <...> graduates may have some knowledge of food sustainability, but it may not be enough to meet the demands of the job market”* (P50). Contributor of a similar opinion LT3 *“Partly, they are trained in cleaning, preparation, food safety and hygiene management. But there are still some procedures where you only learn when you start working. <...>”*. On the other hand, a lack of knowledge about sustainability does not necessarily mean that a graduate is not welcome in the labour market: *“In general, graduates could be better exposed to the importance of sustainability in the food industry, but this is not essential for the job, and the focus is more on professional knowledge related to the specialisation.”* (L1) or *“<...> we concentrate more on knowledge related to direct job functions, lack of knowledge about sustainability does not lead to job failure. But it's good to know about it.”* (L17)

There are also perceptions that knowledge about sustainability is not enough: *“Not always. Students have only a very basic knowledge of sustainability.”* (LT23) and *“No. Training institutions focus more on skills related to direct work.”* (LT28). However, in the future, this knowledge of sustainability will become even more necessary especially in the food industry labour market, as participant P002 mentioned: *“<...> expectation from every employee now that they incorporate the sustainability into what they're doing. So yeah, whether they're passionate or not or they're going into a role that's related to sustainability, they'll need to have that, that kind of knowledge understanding.”*

The analysis of the responses to the question on incorporating sustainability training into education programmes found that it can be a complex process due to the complexity of the concept of sustainability. The example below is a good illustration of it: *“<...> there absolutely has to be <...> more knowledge shared about the complexity <...>. There's definitely room for the am for the undergrad programmes to I guess expose that it's, it's not simple, <...> it's not. Am you can't just say ohh it's all vegan or it's all plant based. <...> there's like there's so many levels of complexity to it that if you are taking in the whole myriad of parameters <...> that impact on climate and <...> there is a balance that needs to be struck. <...> I think we can't lose sight of what a healthy diet is over what a sustainable diet is. <...> sometimes when you're looking at the carbon footprint of 1 particular food, it could be low, but when you look at the water usage of the production of that particular food it's incredibly high, <...>, it's that level of understanding <...>. It's massively complex <...> I guess understood with a level of reason and rationality, and to understand that we are still quite early days in our understanding of this and there's a lot of development that needs to be done to look at the impact of changing dietary guidelines for example, and really understanding what a sustainable healthy diet looks like.”* (P006). It can be stated that there is no single common understanding of the concept of sustainability and how to achieve it. Sustainability is a complex and nuanced issue that requires critical thinking skills to understand, therefore, education needs to address a wide range of sustainability aspects and challenges.

Looking at the second opinion of participant P003, it can be said that training about sustainability in educational institutions can help foster a sense of responsibility and agency in students, by understanding how their individual choices and actions impact the environment *“I would say, have a more kind of practical hands-on approaches and not just for the benefits to the business of being more sustainable, but the benefits to the person as well. <...> they want their*

staff to learn how to grow their own, how to compost, what is the sustainable diet <...> not just sustainability from the business point of view, but the sustainability for the person and their own choices”. In this way, students can feel empowered to make a positive difference in their companies and beyond. According to participant P001, training on sustainability can also have an impact on the industry itself, as graduates who are aware of sustainability will be more likely to choose to work for a company that has sustainability priorities and aims to achieve them: “<...> they really wanted to work with companies that truly had a purpose beyond profit and we’re very, you know, had this independent accreditation and there was no green washing. So I think it’s not just about the graduates actually about the companies as well, if that, you know, young graduates are choosing companies that are doing this very well.”

A high proportion of participants mentioned that educational institutions should educate and inform students about the importance of sustainability, at least the basic aspects. “I think just the fundamentals of at least understanding the baseline of where the food industry sits, where do we impact <...> If you were looking at a product where is the biggest impact coming from <...> a lot of people who don’t have any knowledge <...> just trying to get everyone at the baseline. So at least people are trying to change the mindset of a little bit <...>” (P002). Teaching sustainability in educational institutions can help raise awareness about these issues and encourage students to adopt responsible behaviors, open up career opportunities, to identify problems and come up with creative solutions that balance environmental, economic, and social considerations.

In terms of the integration of sustainability policies into curricula, a focus group conducted by Polish partners discussed how this could be done (Table 11).

Table 11: Ways and opportunities to develop sustainability skills and knowledge in educational institutions by Polish focus group participants listed as category and sub-category (Compiled by Authors, 2023)

Category	Subcategory
Improving sustainability skills and knowledge training in educational institutions	Regular communication with employers to understand the skills and knowledge needed in the industry
	Establishing strong partnerships with employers and industry associations to design programmes that meet the specific needs of the industry
	Offering work-based learning opportunities, such as internships and apprenticeships, to give students practical experience in the workplace
	Integrating emerging technologies and trends into the curriculum to prepare students for the future of work
	Offering flexible and accessible training options, such as online courses and micro-credentials, to accommodate the needs of working professionals.
	Creating competency-based learning programmes that focus on mastery of specific skills, rather than completion of a fixed set of courses.
	Establishing mentorship programmes to connect students with industry professionals and provide guidance and support.
	Incorporating soft skills training into the curriculum, such as communication and teamwork, to prepare students for the demands of the workplace.
	Promoting entrepreneurship and innovation through the development of incubators, maker spaces, and other innovation hubs.
	Leveraging funding opportunities, such as grants and public-private partnerships, to support the development of new education and training programmes.
Providing regular evaluation and assessment of education and training programmes to ensure their effectiveness and relevance to the needs of the labor market.	

As the 11 table above shows there are opportunities to successfully adapt curricula, but it is a complex process that requires the involvement of both business and the education system, introducing new technologies, offering flexible and accessible training options, funding opportunities.

Discussion

The food industry is experiencing substantial changes due to shifting customer expectations, technological progress, and environmental issues. As a result, there is an increasing demand for a workforce equipped with a novel set of skills, which requires continuous updating of qualifications, competencies, and knowledge. In order to create a highly qualified, multi-skilled labour force that can handle the rapid progress within the sector, it is crucial to not only address the current skills gap but also anticipate future skill requirements. This can only be accomplished through innovative and relevant training and educational programmes designed to equip individuals with the competency required to effectively handle these changes. Bridging the gap between the skills of the workforce and the evolving demands of the industry ensures a more adaptable and resilient labour market, capable of responding to both technological advancements and the sustainable practices now central to the food industry⁽³⁾.

A significant portion of these transformations can be attributed to technological advancements, which are reshaping the way food is produced, processed, and consumed. As a result, digital competencies are becoming essential for success in the food industry. Technologies including automation, data analytics, and artificial intelligence are transforming food traceability, safety, and sustainability. Digital tools are progressively employed to optimise supply chains, elevate food safety standards, and boost product quality, a trend anticipated to escalate⁽²⁾. As a result, the demand for employees possessing strong digital competencies is unprecedented. Digital competencies are increasingly regarded as essential for sustaining competitiveness in the rapidly changing labour market of the food business. Consequently, employers must prioritise the recruitment of graduates with essential digital competencies to foster innovation and maintain leadership in industry trends.

Educational institutions are essential in equipping the workforce for emerging demands. It is imperative that they offer training in digital technology while simultaneously endorsing sustainability activities. VET food and health programmes can facilitate the development of knowledge necessary for students and professionals to positively impact the industry's sustainability goals by providing programmes that integrate principles of sustainability, including sustainable agriculture, resource efficiency, waste reduction, and environmental impact mitigation⁽¹⁾. Educators must cultivate an atmosphere that promotes innovation, wherein students are motivated to develop novel competencies and solutions that might advance sustainability in the food industry.

Incorporating sustainability training into VET educational curricula is a crucial advancement in fostering sustainable growth within the food sector. Education serves as a potent

instrument for enhancing knowledge regarding the pressing necessity to confront environmental issues, including climate change, resource depletion, and biodiversity loss. By integrating sustainability ideas into curriculum, educational institutions may prepare future food industry experts to devise and execute sustainable practices. This integration will foster a workforce that is more environmentally conscious, responsible, and ethical, hence aiding in the achievement of global sustainability objectives as delineated by frameworks like the European Green Deal and the UN Sustainable Development Goals (SDGs)^(4,5).

The necessity for new professional competencies in the food business is undeniable, since technological progress and a heightened emphasis on sustainability are transforming the sector. To ensure the workforce is adequately prepared for the difficulties of this shifting terrain, it is essential to continually update training and educational programmes. By addressing present skill demands and anticipating future needs, the food sector can close the skills gap and cultivate a highly skilled, adaptable workforce. Digital capabilities are essential as technology developments in automation, data analytics, and sustainability ideas become increasingly prominent. Moreover, VET education must contribute to the advancement of a sustainable food sector by integrating sustainability training into their curricula, therefore equipping graduates to effect good environmental change. A comprehensive strategy that combines digital competencies with sustainability education will guarantee the food industry's competitiveness and resilience, fostering a more sustainable and fair future.

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1 Appendix

DISHED Focus Group Protocol

Purpose

- The purpose of the DiSHEd focus groups will be to obtain information and get a better understanding of the labour market needs and food sustainability best practices within the food and health sector across the partner countries.
- Focus groups were chosen as the favoured option rather than interviews as they also provide an opportunity for discussion amongst the participants themselves.
- Unlike surveys, focus groups also allow participants to further elaborate on their opinions/views, providing DiSHEd partners with a clearer picture

Description

- The participants of the DISHED focus groups will be individuals, both male and female involved in the agri/food industry sector who employ/supervise graduates from food and health programmes across Europe, specifically from partner countries (Ireland, Poland, Lithuania and Cyprus).
- As there is an occupational range in the sample of the focus groups there will also be a wide range with regards to age. The participants can be from 20 to 65+ years old.
- A focus group will consist of approximately 8-10 individuals which meet the criteria and can foster discussion on the topic of digitalisation and sustainable food practices in industry.

Preparation

- The DiSHEd focus groups should be led by a member of the host organization. The discussions should be recorded but it would be useful to have another staff member present to take notes of the most important points made.
- The location of the focus groups should be some place where participants feel at ease and comfortable to discuss their opinions freely.
- The participants should be sat in a manner where they can face each other so that they have eye contact and can clearly hear each other speak. A circle or round table set-up would be ideal.
- In-person participants should be provided with refreshments.
- In the case where focus group take place online via Microsoft Teams or Zoom participants will log in using an assigned ID number.

Introduction

- The moderator will introduce themselves, the DiSHEd project and its aims and the project consortium. The need behind adaptation of food and health curricula to meet labour market needs will be outlined.
- The moderator will explain the purpose of the focus groups: gain a better understanding of the digital and sustainable competencies employers need in prospective employees, how well employers' feel graduates are prepared to meet today's labour force needs, gaps necessary to address in VET food and health education to increase employability, and what sustainable practices are a priority to the business or company and their plan to achieve those sustainable food practice goals.
- Confidentiality: The moderator will also explain to the participants how the information gathered in the focus groups will be used and who it will be shared for, as outlined in the consent forms

General rules

- The purpose of the focus groups is to gather the opinions and views of the participants. As such there will be no right or wrong answers.
- The expectation of the focus groups is to obtain a range of opinions therefore the participants should not feel obliged to maintain the same perspective as each other but rather their own personal views.
- Participants should feel comfortable to give both positive and negative opinions. They should not stray from being critical if they so feel. The aim of the focus groups is to gain better understanding.
- Participants should talk in an orderly manner, one at a time so that each individual can fully express their thoughts.

Ethical considerations

- Individuals invited to participate in the DiSHEd focus groups have the right to refuse or stop participating at any point during the event. This must be respected by the moderator.
- Moderators must ensure they have permission from all participants to share the information they will provide. They must ensure all participants have signed the DiSHEd Focus Group Consent Form.

There will be three general themes to be discussed throughout the duration of the focus groups. These will be:

1. Perception of Graduate's Preparedness
2. Digital Competency
3. Sustainability

The moderator will be provided with a script and prompt questions for each theme should the discussion seem to slow down.

Introductory Questions

1. Please introduce yourselves and your role
2. How many food and/or health degree graduates do you employ? What are their roles within your industry/company?
3. How do you promote job vacancies for those roles? (intel for the job list search)
4. When advertising for X role, what kind of qualifications are you looking for/require?
5. What training do you provide when someone starts in a role with you?

Sample Questions Theme 1 – Perception of Graduate’s Preparedness

1. Do you believe that the graduates you hired were well prepared?
2. What aspects were they well prepared for and what aspects did you have to focus on in additional training?
3. In your opinion, do you think that the training during their education is effective?
 - a. Any gaps?
 - b. What would you want training to focus on?

Sample Questions Theme 2 – Digital Competency

1. Do you believe graduates are well prepared for this age of digitalisation?
2. What digital capabilities do you expect in your employees?
3. Do graduates currently meet those expectations?
 - a. Any gaps?
4. What training would you like to see for developing digital competency?

Sample Questions Theme 3 – Sustainability

1. Does your industry/company have a sustainability policy for practice?
2. What are your company’s sustainable priorities?
3. How does your company strive to achieve those sustainable food practice goals?
4. Do your graduates’ meet expectations for knowledge and understanding of sustainability and impact in your industry?

Focus group setup

- The discussion should last around 1 hour but no longer than 1.5 hours.
- During virtual sessions participants should use fake names as to protect their anonymity.
- This will not be guaranteed however as we will be transcribing the focus group conversation, no identifying details will be included i.e name, gender. Videos will be destroyed after transcription.

- Each session will be recorded, transcribed, and translated into English so that all partners can have access to the information gathered.
- The Microsoft Teams software will be used to transcribe.
- Participants must be from the agri/food industry sector.

2 Appendix

DISHED Online Survey Questions

Microsoft Forms link:

Demographics Questions

1. Name
2. Country

3. Gender
4. Do you work in the agri/food industry sector? Y/N
5. What company are you employed by?
6. What is your job title?
7. Does your company employ food and/or health degree graduates? Y/N
8. What are their roles within your industry/company?
9. What qualifications do you require for these roles?
10. Do you provide training to new employees? Y/N
 - a. If yes, what type of training do you provide?

Sample Questions Theme 1 – Digital Competency

11. Do you believe graduates are well prepared for this age of digitalisation? Y/N
12. What digital capabilities do you expect from your employees?
13. Do graduates currently meet those expectations? Y/N
14. What training would you like to see for developing digital competency?

Sample Questions Theme 2 – Sustainability

15. What is your understanding of the term sustainability?
16. Does your industry/company have a sustainability policy for practice?
17. What are your company’s sustainable priorities?
18. Please indicate how important the following sustainability competencies are in your organization. (1 = completely irrelevant, 2 = irrelevant, 3 = neutral, 4 = important, 5 = very important)

Indicators of sustainability competences elements	N/A	1	2	3	4	5
Mitigation and adaptation to climate change incl. climate change competences (weather extremes; interdependency of climate systems and biospheres) and climate change mitigation (e.g., fostered CO2 sequestration) and adaptation (e.g., species composition) via sustainable forest management						
Efficient use of resources and logistics						
Improved agri-food system productivity incl. the sustainable management of water, streams, and energy in the food industry						
Active management of natural resources						
Integrated pest management (incl. the sustainable use of pesticides)						
Biodiversity (incl. the detection and support of biodiversity of plants and animals)						
Sustainable metrics and certification incl. public and private schemes for certification (e.g., green labels) and Life Cycle Assessment, Life Cycle Analysis data, including PEF (Product Environmental Footprint)						
Environmental Management Systems						
Corporate social responsibility associated with sustainability reporting/press releases						
National, EU, and international environmental policies, regulation, subsidy, and support programs						
Generation, storage, and the use of renewable energies						

incl. the next generation bio-refineries and bio-product mills and their outlets, residual forest wood products to produce energy and design, and the building and operation of renewable energy systems						
The identification of renewable energy systems suitable for business enterprises						
The identification of raw materials and waste for energy production in business enterprises						
The identification of energy consumption and demand on business enterprises						
Quality management, quality assurance, and quality control incl. sensory evaluation						
Food safety management, food hygiene, and food safety control						
Cleaning and preparation						
Production operations and management (incl. milk processing)						
Preservation and packaging						
Continuous Improvement						

19. Food industries sustainability priorities and goals:

20. How does your company strive to achieve those sustainable food practice goals?

21. Do your graduates' meet expectations for knowledge and understanding of sustainability and impact in your industry?