food paths

Report with assessed skills and knowledge gaps

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1. Executive summary

Currently, food education at the university level is often narrowly defined with courses and specialties limited by a specific topic e.g., Nutrition or Agro-economy. At lower educational levels, lessons on food and sustainability are likely not part of national curricula but may be implemented by individual schools or instructors. This deliverable has the goal of contributing to the creation of a branded network of EU university-driven local ecosystems by reviewing best practices and barriers in sustainable food systems (SFS) education at all levels.

Three steps were followed here: i) a desk study identified educational programs in SFS and personnel involved in them, ii) a series of workshops gathered best practices and barriers to SFS education and included ideas for research and innovation solutions, and iii) an analysis of independent rankings of university programs and practices.

Researching European school programs in SFS from 2018 through present and at all educational levels – Elementary, Secondary, Bachelor, Master, Postgraduate (PostGrad) and Lifelong Learning (LLL) - showed that most SFS programs at the Bachelor/Master/PostGrad level were in Spain, Italy and UK. Face-to-face and online workshops with educational personnel identified most university level best practices in the Teacher Skills and Capacity (18) and most barriers were related to Students, primarily student motivation (11). Research and innovation solutions included 65 ideas and two particular programs currently in progress (Ecotrophelia and Uniworld) were identified as favourite examples of SFS education by the workshop participants.

Results of this three-part study suggest that most education about SFS is taking place at the University level in Europe but there may, however, be a lack of specialization possibilities as few PostGrad programs exist. Both the desk analysis of current SFS programs and the ranking analysis of universities showed three European countries which appear to stand out in SFS education, Spain, Italy, and the UK. Here, a closer look at best practices, particularly relating to student motivation, which was identified as a leading barrier, could be useful. Additionally, the role of these universities in driving sustainability practices in their ecosystems may be applicable throughout Europe. Finally, current LLL practices of unified online offerings may be applicable to developing a branded European network of universities.

2. Introduction and objectives

In an era marked by the intricate and ever-evolving landscape of modern food systems, a need is rising for a fundamental shift in food system education. Current educational programs are often confined to narrow disciplines like Food Science, Nutrition, and Agro-economy, and school curricula at Elementary and Secondary level often don't cover food and sustainability at all, and likely also do not cover the 'systems' approach to food, nor the role of other related disciplines. Recent efforts to link healthy and nutritional diets with complex environmental factors and stakeholder input to find solutions has occurred at the elementary level (Bryant et al., 2023). This is part of a current shift in this mentality, which is giving rise to a promising trend: Sustainable Food Systems (SFS) Education.

Recent EU programs and projects are addressing SFS in several ways. The collection of political initiatives that is the European Green Deal are setting the path for a fundamental transformation of Europe, including a fully sustainable food system as outlined in the farm-to-fork strategy (Marvin, et. al. 2022). In support of the same goals, the EU's research and innovation policy framework Food 2030 is promoting the transition towards sustainable, healthy, and inclusive food systems that respect planetary boundaries. However, neither of these large initiatives focus specifically, or at all, on education.

Sustainable food systems education has been somewhat addressed at specific educational levels by several other initiatives. The ICLEI network includes elementary and secondary schools around the world but offers no specific teaching guidelines for including SFS in education. ICLEI also offers programs at specific universities for Bachelor/Master/PostGrad students addressing local problems, e.g., climate, but again does not offer SFS education. In contrast, several initiatives address SFS education at the adult level i.e., lifelong learning. The EIT Food community offers many online courses for students, consumers, professionals and organizations (e.g., Superfoods: Myths and truths, Setting learning outcomes, New product development training "NPD" skills, ...). Pact4Skills is a networking and knowledge hub focused on the upskilling and reskilling of adults in many areas including sustainable food. This network serves as a repository of courses offered by others (e.g., Supplying the skills needed to achieve the goals of the EU Space Strategy - Event).

Groups involved in SFS education include teachers and administrators but also policymakers, students, and the local community. Here, we brought representatives of these groups together to share success stories and frustrations, and to promote ideas for research & innovation solutions to improve SFS education in their domain. This deliverable reviews the current status of SFS educational programs in Europe and **analyses** best practices and most common barriers as viewed by school personnel to SFS education at all educational levels (Elementary, Secondary, Bachelor/Master/PostGrad, and Lifelong Learning) and in participating European countries. It also integrates the rankings of three independent systems for SFS-related measures of university success. The outcomes should aid university administrators and education policymakers in fostering Food2030-inspired SFS transitions in university education in Europe with the goal of creating a model of exemplary SFS education.

3. Methods

3.1. Desk study of educational programs

A desk study-based search for European education programs in English at five educational levels (Elementary, Secondary, Bachelor/Master, PostGrad, Lifelong Learning) was performed between October 2022 and January 2023. Four blocks of search terms were identified by three researchers using a collaborative and iterative "formulate, test, refine" approach. When for example a search string returned more than 1000 hits, it was made more specific and when a search string returned zero hits, it was broadened. One search block related to educational level, one to food (e.g., food, agriculture, garden, et al.), one to systems (e.g., sustainable, safety, system, et al.) and one to location (e.g., Europe, member states). There were between one and seven terms in each block (Table 1).

Table 1. Search blocks and terms for the desk study search for European education programs.

Education Level	
A	"primary education" OR "primary school"
B	"secondary education" OR "secondary school"
C	"university" OR "university education" OR "tertiary education"
D	"post graduate education"
E	"lifelong learning training" OR "training"
Food-Related	
1	"food"
2	"agriculture" OR "agricultural" OR "Agri-/Agro-"
3	"garden" OR "gardening"
4	"farm" OR "farmer" OR "farming"
Sustainability-related	
5	"safety" OR "safe"
6	"sustainable" OR "sustainability"
7	"system"
8	"local"
9	"community"
10	"interdisciplinary"
11	"food chain" OR "value chain" OR "food value chain"
Geographic	
12	"EU" OR "Europe" OR "Particular MS"

Online search locations were identified by three primary researchers with suggestions from colleagues in the FOODPathS project. These included standard databases such as Google to identify programs as well as educational and teacher groups; association databases such as the ISEKI-Food Association Curricula database (https://www.iseki-food.net/curricula); and European Union databases such as that of Erasmus+ (The "EU programme for education, training, youth and sport") projects (https://erasmus-plus.ec.europa.eu/it/projects) and Horizon (https://cordis.europa.eu/projects). Additionally, professional contacts and websites of project partners (ICLEI Europe and EFFoST) and relevant projects (EIT Food and FNS-Cloud) were contacted (Table 2). All searches covered the period 2018 through present (2023).

Table 2. Online search locations for each educational level.

	Erasmus+	Google	ISEKI-Food	Teacher Associations	Professional contacts
Elementary	X				X
Secondary	X			X	X
Bachelor/Master		X	X		
PostGrad		X	X		
Lifelong Learning		X			X

3.2. Workshops

Five online workshops were planned, one for each educational level (Elementary, Secondary, University, PostGrad, and Lifelong Learning), between December 2022 and February 2023. One face-to-face workshop brought representatives of all educational levels together in April 2023.

All 210 programs and/or people affiliated with European SFS education as identified in the desk study, received an email invitation to participate in the online workshop of their educational level. The emails outlined the goal of the online workshop and informed about the face-to-face workshop, including that participant expenses would be paid. Educators at all levels i.e., extracurricular aides to policy and curriculum designers, were invited. The invitation also asked that relevant colleagues be invited (Section 7.1, Sample Invitation Letter).

Each online workshop was led by at least two FOODPathS facilitators, lasted approximately two hours, and used the program Miro© for participant activities. After a short icebreaker and a presentation of the FOODPathS project, facilitators introduced seven key categories in the transition to SFS education i) time, ii) students, iii) policy frameworks, iv) financial, v) teacher skills and capacity, vi) institutional and management, and vii) other (Melin et al., 2022). Participants used silent reflection to gather their ideas on best practices in SFS education, wrote short statements about each best practice and placed them in the box(es) corresponding to the relevant driver(s), then participated in a plenary discussion about their experience with best practices in SFS education. The same methodology was used with a focus on barriers to effective SFS education. Each workshop closed with a facilitator-led plenary discussion on possible R&I solutions to the identified barriers (Section 7.2, Sample Facilitator Agenda).

The word-for-word notes of workshop participants were anonymized and converted into three spreadsheets, one each for drivers, barriers, and solutions. Each participant comment was linked to i) educational level and ii) transition category. Three researchers came to consensus on each participant comment in order to transform them as follows:

- Sentence for bullet point reassigned within the driver, barrier, and solution spreadsheets and/or separated into more than one comment e.g., a comment from the barrier Miro board might contain both a barrier and a solution.
- Simplified to remove connecting words such as "from" and "through" and obvious words such as "sustainability" and "food".

Simplified versions of participant comments were analysed word-for-word using NVivo 12 Pro© software for qualitative analysis to prepare word clouds. The analysis included only words with at least four letters, and combined words with the same stem, e.g., cook and cooking.

The number of barrier, driver, and solution comments for each transition category (barriers and drivers only, solution comments were not specific to transition category) within each educational level were calculated. These were compared to expected values (assumption that comments at each educational level are equally distributed among the seven transition categories) using the chi squared statistic and $p < 0.05$ considered significant.

At the face-to-face workshop, three facilitators led a 6-hour session. Here, participants viewed a summary of the results from each online workshop then worked in small groups based on educational level and then on transition category across educational levels. The aim was to detail and elaborate their best practices in SFS education including the drivers and contact people, and to identify barriers and R&I solutions to further progress in SFS education.

3.3. Mapping European Universities

The primary focus of universities (and other schools) is on education; however, their exemplary roles as drivers for sustainability projects in their local ecosystems should not be overlooked. Three databases of rankings were used to identify universities that are either leading in the field of Agro and Food technologies and/or leading in environmental and social impact. These are the Shanghai Ranking – Global Ranking of Academic Subjects (GRAS), the UI GreenMetric World University Rankings, and the QS Sustainability Rankings. Each of these ranks' universities based on different criteria (Table 3), with Shanghai Ranking focusing on objective academic indicators, UI GreenMetric on green campus and environmental sustainability, and QS Sustainability on environmental and social impact. Only those universities in the EU Member States and Associated Countries were considered and counts of universities *per* country were summed from the 2022 ranking.

Table 3. Summary of three university ranking systems and their criteria.

	Shanghai Ranking	QS Sustainability	UI GreenMetric
Ranking criteria	Research output	Sustainable institutions	Setting & Infrastructure
	Research influence	Sustainable education	Energy & Climate Change
	International collaboration	Sustainable research	Waste
	Research quality	Equality	Water
	International academic awards	Knowledge exchange	Transportation
		Impact of education	Education & Research
		Employability and opportunities	
		Quality of life	
Ranking methods	Range of objective academic indicators for each academic subject	Environmental and social impact	Environmental commitment and initiatives
	Third party data	Self-assessment data + third party data	Self-assessment data + third party data
	500 universities in Agricultural Sciences 300 universities in Food Science & Technology ranked worldwide	700 universities ranked worldwide	1050 universities ranked worldwide
	271 MS universities	206 MS universities	144 MS universities
	66 AC universities	81 AC universities	117 AC universities

4. Results: Skills and knowledge gaps in sustainable food systems (SFS) education

The strategy to assess skills and knowledge gaps in SFS education comprised three studies, (1) desk study-based search for European education programs at all educational levels (Elementary, Secondary, Bachelor/Master, PostGrad, Lifelong Learning); (2) online workshops for each educational level and a final face-to-face workshop with all educational levels to identify drivers, barriers and solutions for SFS education; and (3) mapping study of exemplary sustainable university campuses.

In the desk study, 195 unique programs were identified through all educational levels and covering most MS countries (except Cyprus, Estonia, Luxembourg, Malta). Six associated countries were included (Albania, Macedonia, Moldova, Norway, UK, Ukraine) and 1 other country (Russia).

There were five online workshops with 25 total participants who generated 395 ideas for SFS education drivers, barriers, and solutions (Table 4). There were no attendees for the PostGrad level online workshop despite 250+ invitations sent. At the face-to-face workshop, 25 participants were divided in three working groups (Elementary/Secondary, Bachelor/Master/PostGrad, Lifelong Learning) and they identified and presented new drivers, barriers and solutions.

The mapping of exemplary universities considered not only a strong curriculum (Shanghai ranking), but also corporate practices such as gender equality, sustainable food, packaging, waste, and biodiversity policies (QS Sustainability), and their role in local and regional communities by for instance aiding spin-offs or involving local producers and citizens (UI GreenMetric). Mapping used the 2022 rankings of universities in European member states and associated countries.

Table 4. Number of attendees for each level of education and number of drivers, barriers and solutions generated.

Educational level	Number of participants	Participant countries	Number of drivers	Number of barriers	Number of solutions
Elementary	4	Ireland (2) Croatia (2)	61	48	25
Secondary	4	Greece (2) Netherlands (2)	36	16	12
Bachelor, Master & PostGrad	12	Bulgaria (1) England (2) Greece (3) Poland (1) Italy (3) Serbia (1) Germany (1)	60	44	17
Lifelong learning	5	Greece (3) Italy (1) Spain (1)	33	32	11
Total	*25*	*11*	*190*	*140*	*65*

4.1. Existing education in SFS, elementary through lifelong learning

For all educational levels, all 23 possible search combinations were used in the Erasmus+, Horizon, and Google searches.

For elementary, at least 7 search term combinations returned 25 unique projects (Figure 1) which were judged relevant after review of the project abstract. Keywords used for selection were teaching experiences, educational activities, teaching methods, learner (students) experiences related to safe and sustainable food systems. The SFS elementary programs were in 15 MS countries and 1 associated country (UK), 1 program was found in two countries (Croatia and Slovakia). The country with the highest number of programs was Poland (six) followed by Ireland (three).
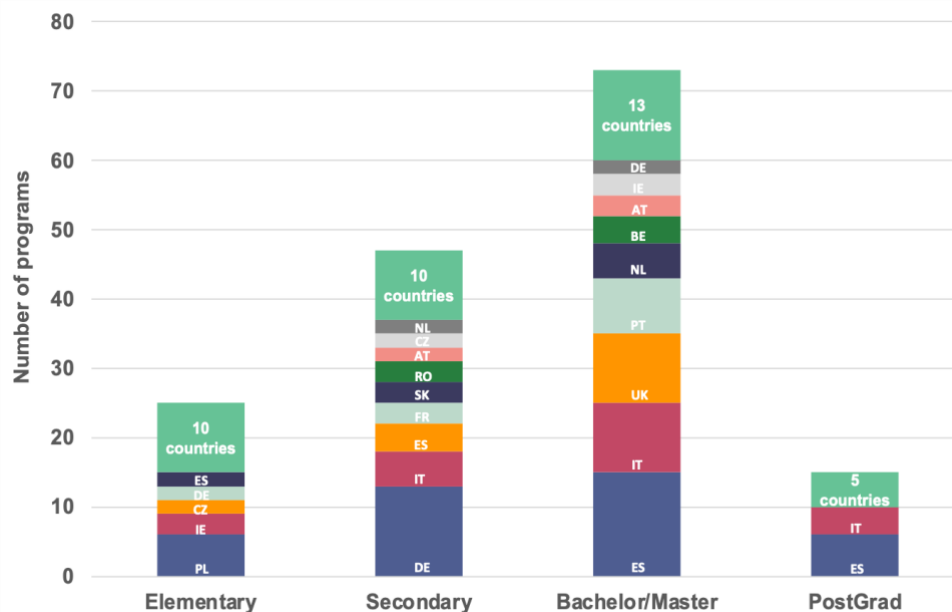

Figure 1: Number and location of programs on SFS education at each educational level. Light green color corresponds to only 1 program found per country.

For secondary, at least 16 search term combinations returned 47 projects (Figure 1) judged relevant following the same abstract review as elementary. The SFS secondary programs were in 17 MS countries and 2 associated countries (Norway and UK). The country with the highest number of programs was Germany (thirteen) followed by Italy (five) and Spain (four).

For Bachelor/Master, 7 search term combinations returned 62 university programs. A letter to 300+ IFA members asking their interest in participation, returned 12 programs for 74 programs total (Figure 1). The SFS university programs were in 23 countries, 15 from the MS, 6 from associated countries (Albania, Macedonia, Moldova, Norway, UK and Ukraine), and 1 from Russia. The country with the highest number of programs was Spain (fifteen) followed by Italy and the UK with 10 programs each.

For Postgraduate, 2 search term combinations returned 13 Post Graduate programs and the letter to IFA members returned 2 additional programs for a total of 15 programs (Figure 1). The SFS Post Grad programs were in 5 MS countries and 2 associated countries (Moldova and UK). The country with the highest number of programs was Spain (six) followed by Italy (four).

For Lifelong Learning (LLL), 8 search term combinations returned 48 programs and the letter to IFA members returned 1 additional program. The LLL programs were mainly offered online and are not included in Figure 1.

These results suggest the presence of SFS programs at all educational levels in most EU MS and in some associated countries. The limit of the search to programs in English likely means that more programs exist

which were not identified by this study, especially at Elementary and Secondary level where education is most likely to be in the native language.

The large number of Bachelor/Master compared to Post Grad programs might be due to the relative novelty of SFS education and a corresponding lack of mentors and research opportunities for advanced study. The countries with the most Bachelor/Master programs (Spain and Italy) are also the countries with the most PostGrad programs, suggesting a not surprising relationship between the number of training opportunities for SFS professionals at the University level and the number of opportunities for advanced study. A repeat search for PostGrad programs several years from now would be needed to confirm this theory.

4.2. Identification of best practices at all educational levels

A word cloud analysis of the 190 SFS education drivers raised at the online workshops from all educational levels showed Garden as the most common word with Activities and Involvement also mentioned often (Figure 2). Two word-for-word examples from the workshops are here: "Kitchen Garden for very young students"; "Challenges e.g., which class wastes less food?".

In the face-to-face workshop, the working group for **Elementary/Secondary** education again identified Garden, Activities, and Involvement as key drivers when they emphasized after school clubs for students and parents together, to increase gardening and entrepreneurship competences. Among Activities, teacher training was stressed (e.g., cooking classes) and Involvement of schools in sustainable food outside of education (e.g., food procurement) along with collaboration with external stakeholders and experts.

The **Bachelor/Master/PostGrad** group focused on Activities and Involvement, identifying as drivers' situations that allow students to cooperate with professionals in real life development of products, e.g., using food industry by-products. Similarly, the **Lifelong Learning** working group preferred Activities as the most important driver, identifying e.g., face-to-face seminars with emphasis on "learning by doing" as successful, particularly when joined with accreditation.

Figure 2: Word cloud analysis from driver comments from all educational levels.

In the face-to-face workshops, each group provided at least one real example which they considered the best example of successful SFS education. They provided the reason for their choice(s) and the person to contact (Table 5). The Elementary/Secondary groups identified one best example in Ireland, the Bachelor/Master/PostGrad and LLL group identified two and three best examples, respectively.

Table 5. Best real examples of SFS institutions

Educational level	Best example (country)	Description	Contact
Elementary Secondary	Carlow Educate Together National School (CETNS) (Ireland)	Students are engaged in several gardening activities such as bringing home food that they grow at school, thus involving their families and including community engagement in the process.	Mark O'Brien Teacher mark@carloweducatetogether.ie
Bachelor Master PostGrad	Food Hackathon (France)	ECOTROPHELIA, a cooperation between educational programs and companies organizes a competition where students address specific challenges presented by the food industry.	Dominique Ladeveze Founder dominique.ladeveze@ecotrophelia.org
	Boutique River Cruises (Ireland)	Uniworld, a six-star cruising company which serves meals of 5-6 elaborate courses, has a sustainability program in which food waste is measured. This helped reduce waste by 50-60%.	Julie Higgins Sustainability Officer for Uniworld LinkedIn Profile
Lifelong learning	Perrotis College (Greece)	Face-to-face seminars (some accreditation) with a methodology of "learning by doing" – the theory and practice are balanced and focus on what is critical for adults, e.g., environmental skills and knowledge, home food processing. Food Processing Preservation Short Course – gathers people from different educational levels and is a great starter to change careers in the food sector	Kiriaki Zinoviadou Professor kzinov@afs.edu.gr
	University of Food Technologies (UFT) (Bulgaria)	New Methods for Food Safety and Security Huge interest from adults, organisations and industries and has sparked a networking opportunity with a dose of fresh knowledge by sharing good practices	Angel Angelov Professor angelov@uft-bio.com
	Food industry Union (Bulgaria)	Training courses for adults who wish to start a new carrier in food industrial sectors (e.g.; dairy, bakery); Travel seminars with different and timely chosen topics related to food industry, a chance to be positively motivated and enjoy traveling by visiting companies, learning and obtaining an accredited certificate serving as a basis for a professional development, a change in career or addition of practical skills.	Velitchka Gotcheva Professor gotcheva_v@uft-bio.com

Drivers for SFS education were assigned by online workshop participants to one (or more) of seven categories required for a transition or "greenshift" in sustainability education (Melin et al., 2022). Comparison of number of drivers by transition category and educational level (Figure 3) showed a range from zero for the "Other" category at the Lifelong Learning level to 18 in the Teacher skills & capacity category at the Bachelor/Master level. Chi squared analysis showed a significant difference between the observed distribution of drivers and the expected equal distribution among all categories and all educational levels (p=0.0008). The small number of driver ideas in the "Other" category and the relatively homogeneous distribution throughout the six named categories supports the work of Melin et al. (2022) in identifying these six areas as key for SFS education.
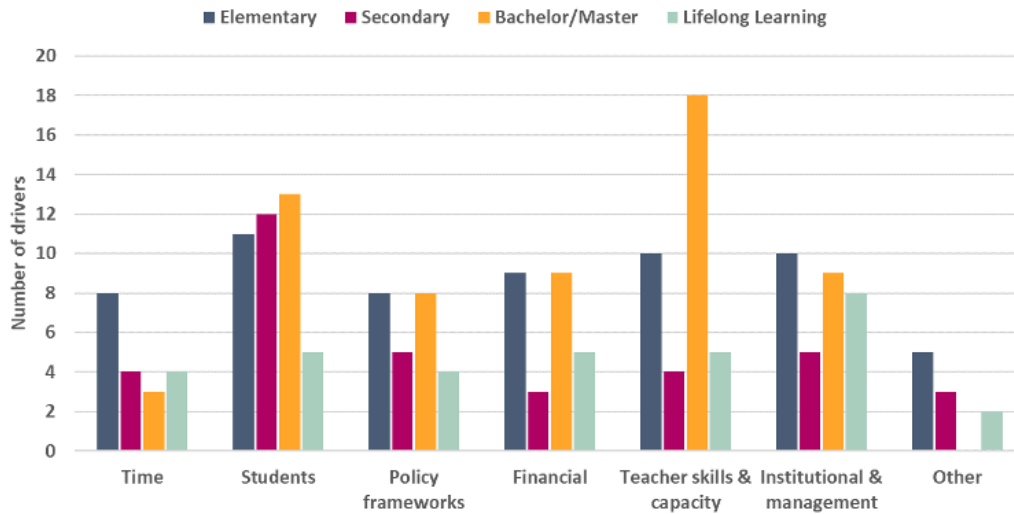

Figure 3: Distribution of driver ideas for SFS education at four educational levels and across seven transition categories.

A series of chi-squared analyses examined distribution of driver ideas among the transition categories within each educational level and this showed a significant difference only at the Bachelor/Master level (Figure 4) where the Chi squared statistic was $p = 0.0004$. The Teacher skills & capacity category generated 18 driver ideas while the "Other" category generated zero and the Time category three. Again, all relevant drivers at this level appear to fit into the six categories provided. Additionally, the strengths of people involved i.e., the skills of teachers and the motivation of students (e.g., "Try and keep interests' level high", "genuine interest"), seem most important in quality SFS education at the university level.
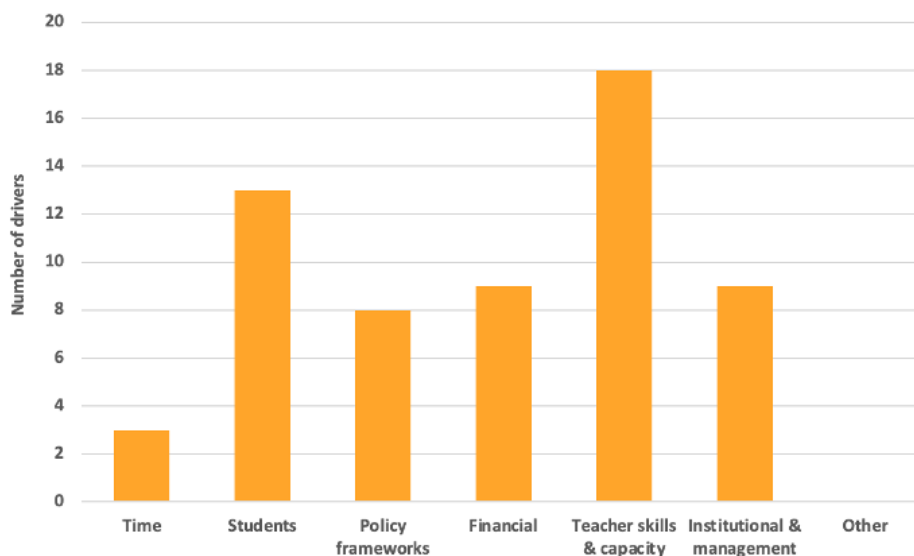

Figure 4: Distribution of driver ideas for SFS education at the University (Bachelor/Master) level and across seven transition categories

4.3. Identification of barriers and solutions to formulate R&I needs at all educational levels

A word cloud analysis of the 140 SFS education barriers raised at the online workshops from all educational levels showed Time as the most common word with Curriculum and Lack also mentioned often (Figure 5). Some word-for-word examples from the workshops are here: "Time is crowded with other school activities leave little time for SFS topics", "Curriculum overload", "It is difficult to incorporate to the curriculum", "Teachers need to use own initiative to add SFS in their subjects".

In the face-to-face workshop, the **Elementary/Secondary** working group identified the three most important barriers as i) Lack of time in curriculum, ii). Silos that block cooperation amongst sectors and hinder multidisciplinarity, and iii) lack of infrastructure to create activities such as gardening.

The **Bachelor/Master/PostGrad** group similarly identified i) rigid institutional programmes and fixed curricula, and ii) lack of communication and collaboration among disciplines. The **LLL** group had a different perspective, identifying i) lack of time in adult student's lives, and ii) employers do not invest time or resources in training personnel.

Taken together, data from both online and face-to-face show that the "Lack" in quality SFS education is associated with time, collaboration, and activities across all educational levels. They further stress that fixed curricula, apparently not modifiable by instructors, are considered a problem from Elementary through PostGrad education. Working with a time period of 10-20 years, a real change in education could shift curricula by allowing both deep knowledge in a specific domain and transdisciplinary SFS studies. Only LLL, where course content is generally determined by the provider, did not mention curriculum as a barrier. The freedom for course development to respond to societal interest at the LLL level, where only those so inclined take the courses, has allowed several interesting programs to appear including Food Systems Academy and an eLearning series organized by the FAO.

Figure 5: Word cloud analysis from barrier comments from all educational levels.

The same as for drivers, barriers to SFS education were assigned by online workshop participants to one (or more) of the seven categories previously identified. Comparison of number of barriers by transition category and educational level (Figure 6) showed a range from zero for the "Other" category at the Secondary educational level to 11 in the "Students" and "Teacher skills & capacity" categories at the Bachelor/Master and Elementary levels, respectively. Chi-squared analysis showed a significant

difference at p=0.01 between this distribution of barriers and the expected distribution of equal number of barriers at all levels in all categories.

A series of Chi-squared analyses examined distribution of barrier ideas among the transition categories within each educational level and this showed no significant difference at any level, suggesting that within each educational level all barrier categories are equally important. This is different from the analyses for drivers, where at the Bachelor/Master level there was one SFS transition category, "Teacher skills & capacity" more important than others.

Analyses of barriers showed that the number and categorization of ideas (Figure 6) and the words used to express those ideas (Figure 5) did not seem to agree; this contrasts with the analyses for drivers. The barrier word cloud shows "Curriculum" as perhaps the most important barrier, yet the categories of "Policy frameworks" and "Institutional management" where a barrier related to curriculum would be expected, were not among the top categories for barriers. An explanation for this might come from a wide variety of words used to describe a wide variety of barriers related to "Teacher skills & capacity" and "Students", the two top categories for barriers. In these categories there are comments about habits and attitudes ("teachers find it difficult to change their less healthy habits" and "Motivation is not equally shared between students") and comments about money and applications ("If a teacher wants to apply these methods, usually they pay out of pocket for supplies" and "visa, admission procedure"). Clearly many different words were used to describe these diverse barriers which were then similarly categorized as barriers related to "Teacher skills & capacities" or "Students". Comments related to curriculum on the other hand always used the word or its root ("curricula need restructuring e.g. consider green deal" and "it is difficult to incorporate to the curriculum"). There were no comments in "Policy frameworks" or "Institutional management" which referred to curriculum with another word e.g., "module" or "syllabus".
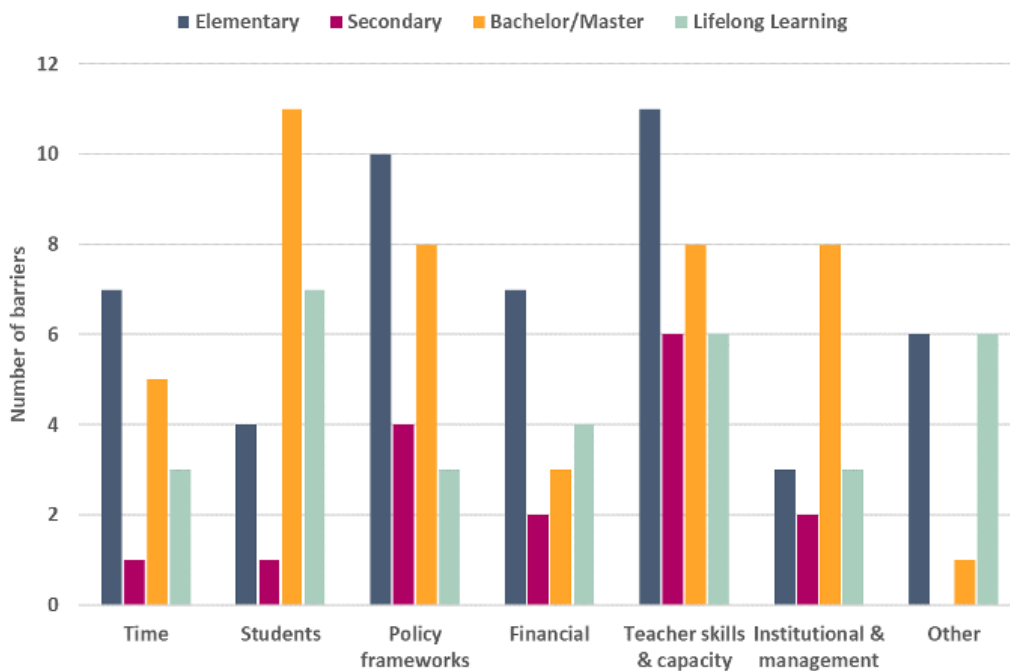
Figure 6: Distribution of barrier ideas for SFS education at four educational levels and across seven transition categories.

A word cloud analysis of the 65 solutions raised in the online workshops showed "Involvement" as the most common word with "Training" and "Activities" also mentioned often (Figure 7). "Involvement in real life case solving", "Short activities, bite-sized, to fit SFS education into the curriculum", "Teacher's training" are some word-for-word examples of comments from the online workshops.

In the face-to-face workshop, the **Elementary/Secondary** working group identified the following solutions i) gardening/sustainability after school clubs with involvement of teachers and experts, ii) increased multidisciplinarity, iii), incentives for finding solutions, and iv) political support.

The **Bachelor/Master/PostGrad** group proposed i) increasing sensibility by e.g., adding the word "waste" and the relevant content to established courses (Food Technology & Food Waste), ii) adding sustainability as a criterion in education metrics, and iii) increasing involvement through e.g, student competitions such as hackathons, interdisciplinary educational workshops, and student projects. The **LLL** group suggested i) a mix of online and in-person courses to address the lack of time of their adult students and ii) grants, government support and employer obligations for staff training and certification.

Figure 7: Word cloud analysis from solution comments from all educational levels.

Unlike the analyses of drivers and barriers, the R&I solutions for the transition to exemplary SFS education were not assigned transition categories but they were organized by educational level. The number of R&I solutions (Figure 8) ranged from 11 in Lifelong Learning to 25 in Elementary, with no significant difference in number of solutions by educational level (p=0.056). At each educational level, there were more barriers than solutions, though this difference was not tested statistically.

Figure 8: Distribution of solution ideas (full color) and barriers (shaded color) for SFS education at four educational levels.

4.4. Identification of European universities to act as SFS actors

Review of a combination of three ranking systems, Shanghai Ranking, QS Sustainability Ranking, and UI Green Metrics showed that almost all MS have at least 1 university listed. Only Luxembourg and Malta were not represented in any of the three rankings, which could be attributed to the small populations of these two countries (data published on D2.1-Table 7).

There were variations by country and ranking system for the 25 MS with listed universities. Only Spain and Italy had more than 20 universities listed in each of the three rankings (Figure 9), suggesting that these countries have outstanding universities based on i) merits in agricultural and/or food science & technology, ii) green campus and environmental sustainability, and iii) commitment to improve their environmental and social impact. It is not clear if the same universities are noted in all three ranking systems or if certain universities are superior in academics and others in sustainability and/or impact. This is a subject for future investigation.

France and Germany had more than 20 universities noted for agricultural and/or food science & technology and more than 20 noted for commitment to improve their environmental and social impact (Figure 9). However, these two countries are not well represented in the UI GreenMetric ranking for green campus and environmental sustainability. Since the UI GreenMetric ranking relies on self-assessment, it is possible that not many French and German universities participated, perhaps preferring other ranking systems for these measures.

Turkey stands out for the UI GreenMetric ranking as well as Ukrainian universities not reflected in the other rankings (Figure 9). UI GreenMetric does pull in universities from countries that could be at a disadvantage with the QS and Shanghai Ranking. Norway and Switzerland, on the other hand, have fewer universities in the UI GreenMetric ranking and in the case of MS countries this reflects on most of the countries except in a significant number for Italy, Spain, Hungary, Poland and Romania.
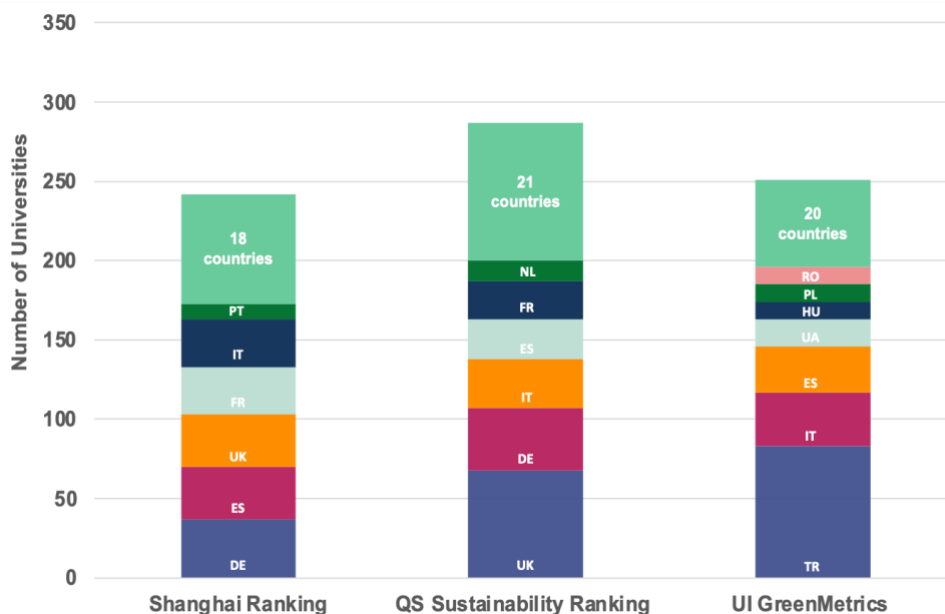

Figure 9: Number and location of universities in the three rankings by European MS. Light green color corresponds to less than 10 universities ranking per country.

5. Conclusions and recommendations

The desk study of SFS programs at the Bachelor/Master level and the mapping of exemplary universities based on ranking systems return a similar conclusion about SFS education in Europe: Spain, Italy and UK are countries of potential interest. These three countries i) have the largest number of university programs in SFS education, ii) contributed to the database of best practices in current SFS education, and iii) have the most universities with rankings in the three systems (considering academic excellence, environmental sustainability, and environmental/social impact). Identification of the specific universities, and especially any that are noted in all three categories, together with incorporation of best practices identified by top ranked universities will allow the next steps of proposing a model of exemplary SFS education. As shown in Figure 10, the universities found at the intersection of relevant rankings, and which have SFS Bachelor/Master programs are those of the most interest.
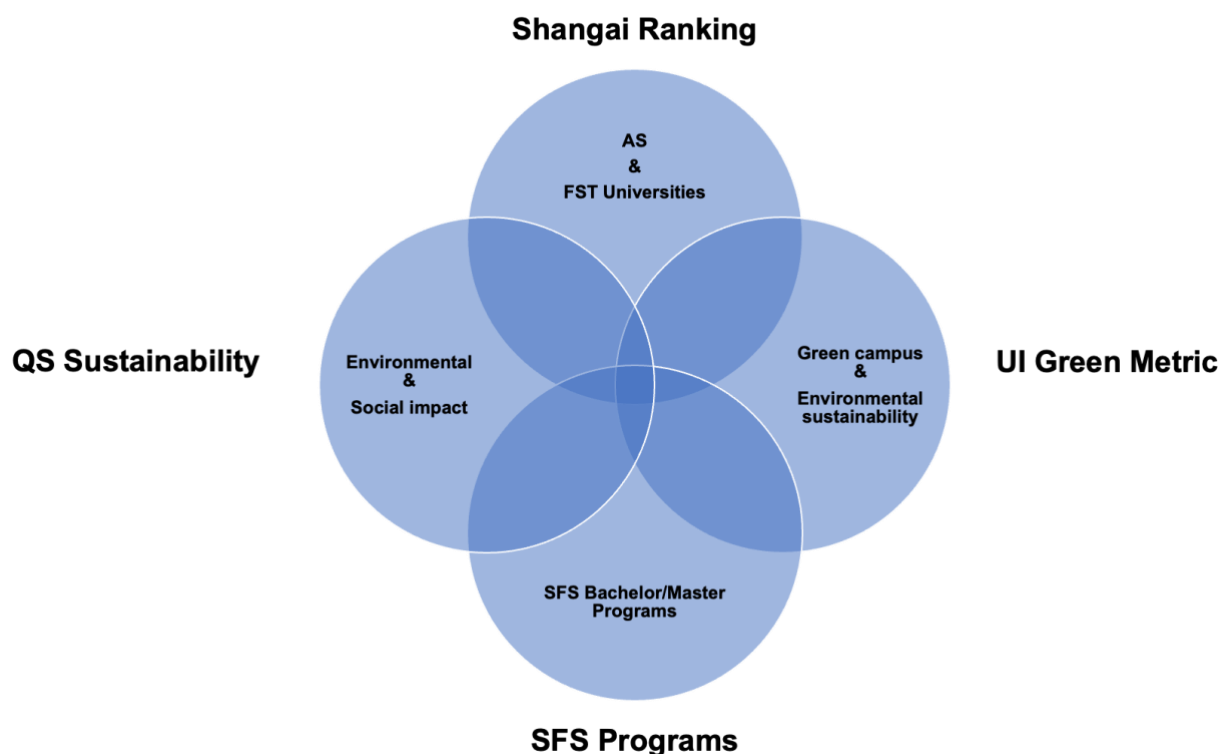

Figure 10: Visual representation of the most interesting universities found at the intersection of the three rankings and SFS programs.

Among the best practices identified in workshops, the term Living Lab was not specifically mentioned but was nevertheless suggested at several educational levels. The primary school in Ireland which uses gardens and community involvement in SFS education (Table 5) was in effect a Living Lab as part of an Erasmus+ project. At the Bachelor/Master level, suggested solutions to SFS education weaknesses included Living Lab-like experiences in which students solve a real-life case in industry. The future Partnership-SFS focus on Living Labs, and possible collaboration with the ENOLL network, could thus likely include SFS education at all levels.

Living labs might also include postgrad students working with mentors in the Lab. Such programs would help to address the apparent lack of mentors for postgrad students, which was implied by the low number of current postgrad programs. Additionally, the newly developed mentorship programs of EHEDG and EFFoST could offer Living Lab experiences. A continuation of such programs by other food-related organizations, projects, and initiatives (e.g., ISEKI, EIT-Food, BIOEAST) could steer SFS education as a contributor in the future Partnership-SFS.

A [Pact4Skills](#) model applied to SFS University education could consist of a similar online portal where member organizations could:

- join forces with other members to support SFS education/practices at their university.
- create or publicize Living Labs and their results, including attracting participants and hosts.
- connect with the [Association for European Life Science Universities](#) (ICA).
- access EU-level labour market intelligence for use in curriculum planning.
- learn more about accessing national and EU funding opportunities for an SFS transition.

The joint action model of Pact4Skills, where national, regional, and local authorities; companies; social partners; cross-industry and sectoral organizations; chambers of commerce; education and training providers; and employment services work together can be of value also in a university setting. This variety of stakeholders could contribute to curriculum planning (what is needed), teaching (including site visits), and campus life.

This branded network of European universities should motivate the organization, staff, and students to foster Food 2030-inspired food system transition for co-benefits relevant to their internal corporate practices, local and regional communities.

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7. Attachments

7.1. Sample invitation letter

FOR SECONDARY EDUCATION

Dear Project Coordinator,

We are interested in your work! Your Erasmus+ project, XXX, is addressing similar issues to our H2020 FOODPathS project.

Our aim is to gather best practices, lessons learned, and difficulties encountered in teaching about safe and sustainable food systems by allowing teaching practitioners to share their experiences. We will organize an online workshop where participants will learn from each other. From your stories, we will together draft guidelines on Research and Innovation needs in teaching about safe and sustainable food systems and present these to the European Commission.

We're interested in any coursework you might have given and/or designed and in any student learning experiences you might have observed. Experiences with extra-curricular activities in e.g., gardening or meal preparation are just as important for us. We're also interested in the design of course materials and curricula planning/development, for example at a school, city, or regional level. In short, any educational experience relating to safe and sustainable food systems.

In the FOODPathS project, we will organize a series of workshops with educators in the EU, at all levels of education and for professionals in all roles in education, from teacher's aides through education administrators. All workshops will be in English. **You are cordially invited to participate in the online workshop for SECONDARY EDUCATION scheduled for THURSDAY 12 JANUARY 2023 from 14H00 to 16H00 CET.** If you are not available, or not the right person for this, please pass the invitation on to a colleague. From this workshop, a subset of participants will be invited to a physical meeting in late January 2023 in Vienna with representatives from all levels of education. Participant travel and accommodation for this second meeting would be paid by the FOODPathS project, but no one will be required to attend this second meeting.

Are you interested in the first online meeting? Please respond to this email by end of day MONDAY 14 NOVEMBER to confirm your attendance.

7.2. Sample facilitator agenda

foodpaths

Lifelong Learning Workshop 19 January 2023, 10H to 12H. online

Facilitator Agenda

OVERALL AIMS of the WORKSHOP:

- to share lessons learned (best practices/drivers and problems/barriers).
- to formulate R&I needs on SSFS training.
- to identify participants for the 2023 F2F workshop (for writing guidelines for SSFS lifelong learning (childhood to experienced employees).

Topics to discuss in today's workshop:

Essential aspects of the transition to education for sustainable agrifood systems. Categories of best practices/ hindrances *financial, institutional and management, policy, students, teacher skills and capacity, time, other*. (from NextFOOD)

10H00 Welcome and icebreaker in Miro (KF)

Overall aims.

Let's try Miro https://miro.com/app/board/uXjVPxn0D_o=/

Hints about Miro. Bottom right to zoom in or out. Right click and drag to move. Control c and control v to copy and paste a sticky note. Arrows to connect sticky notes.

10H15 Introductory powerpoint (FS)

Goal of the workshop/of the workshop series

5 online workshops at 5 educational levels

1 F2F workshop with participants from all educational levels

What is a SSFS

What is FOODPathS

Introduce the 4 key aspects of SSFS education

10H30 Best practices and their drivers (KF)

We start by being very positive. Only positive. For the pessimists in the group, don't worry as we'll get the chance to be negative later in the workshop!

5 minutes of silent reflection (while writing notes) on best practices/good examples/what you admire in SSFS education that you have experienced or heard about. It might be helpful to

remember these 4 aspects of the transition to SSFS *1) Student learning and outcomes; 2) Pedagogy and learning approaches; 3) Values and hidden curriculum; 4) Quality standards and assurance.*

5 min instructions: Group work in Miro. https://miro.com/app/board/uXjVPxgVRJ4=/

Decide a timekeeper/facilitator and a rapporteur (if the group is big enough). Think about your best practices/good examples and briefly describe each on a sticky note (yes, briefly) and put it in the category of what helps to make this best practice happen : *financial, institutional and management, (international and national) policy, students, teacher skills and capacity, time, other.* A best practice/ good example may be helped by more than one driver i.e., it can go in more than one category. This will be a 15-minute group work in which the group continues to write and organize their best practice ideas on sticky notes and places them in one or more of the 7 categories.

15 min Group discussion and Miro Board action.

5 min rapporteur presentation

11H00 Best practices and their barriers group work

Now it's time to be negative, sad face.

5 min Silent reflection (while writing notes) on problems/barriers/setbacks in SSFS education that you have experienced or heard about. Remember again the 4 aspects of transition to SFSS education and that barriers can be e.g. structural or cultural.

5 min instructions. Back to group work in Miro. https://miro.com/app/board/uXjVPxgVR8U=/

Decide a timekeeper/facilitator and a rapporteur (if a big enough group). Think about the barriers to SFSS education and briefly write each one on a sticky note and put it in the category for type of barrier. Remember a single barrier can go in more than one category. This will be a 15-minute group work in which the group continues to write and organize their barrier ideas on sticky notes and places them in one or more of the 7 categories. We are NOT thinking here about how to fix these problems, that will come later. Here we are totally negative, only focused on what does not work.

15 min Group discussion and Miro Board action

5 min rapporteur presentation

11H30 What R&I do you need in your institution/course to overcome barriers

5 min Silent reflection (while writing notes) on what might be done to overcome barriers. Remember to consider structural and cultural *methods.*

15 min Group discussion while KF writes in Barriers Miro Board

11H45 Wrap up and goodbye