Deliverable 5.2

January 30, 2025

TOWARDS A BRANDED NETWORK OF EXEMPLARY UNIVERSITY-DRIVEN LOCAL FOOD ECOSYSTEMS

foodpaths

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Towards a branded network of exemplary university-driven local food ecosystems

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Abbreviations

HERI	Higher Education & Research institutions
EHEA	European Higher Education Area
R&I	research & Innovation
SFS	Sustainable Food Systems
SRIA	Strategic Research and Innovation Agenda
P-SFS	Partnership on SFS
FS SWG	Food Systems Strategic Working Group
SCAR	Standing Committee on Agricultural Research
HEIs	higher education institutions
SFS	Sustainable Food Systems
EGTC	European Grouping of Territorial Cooperation
EEIG	European Economic Interest Grouping
UniFE	Universities and the future of Europe
EUI	European Universities Initiative
ENQA	European Association for Quality Assurance in Higher Education
ECA	European Consortium for Accreditation in higher education
RRI	Responsible Research and Innovation
FAIR	Findable, Acessible, Interoperable and Reusable
RIPE	Research & Innovation, Policy and Education
FS-Labs	Food Systems Labs
EDIB	equality, diversity, inclusion and belonging
EUA	European University Association
SRIA	Strategic Research and Innovation Agenda

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Executive summary

Research and Innovation (R&I) is a cornerstone for the EU in driving the transformation towards Sustainable Food Systems (SFS) for People, Planet, and Climate. The success of this transition depends on the active collaboration of diverse actors, including an EU Partnership, (trans)national networks, and local ecosystems—all united by a mission for change. A key step in achieving this goal is fostering cooperation among Higher Education and Research Institutions (HERI) engaged in food systems transition and linking those collaborative networks to wide range of actors. This requires investing in knowledge transfer and training initiatives to build food systems awareness, including developing education programs and competence-building processes across all educational levels.

This deliverable report aims to discuss the concept of cooperation among leading universities for organising an ecosystem of innovation in practice and teaching for SFS. The assessment of the possibilities and relevance of collaborative networks of HERI should bring recommendations for a better implementation of the SFS principles, systematically developed within the FOODPathS project and included in the prepared Strategic Research and Innovation Agenda (SRIA) for the Partnership on SFS (P-SFS) for People, Planet, and Climate.

These activities include several elements that are integral to the governance system, which the Partnership should consider as a set of complementary organisational activities for better support of broad stakeholder collaboration, thereby providing support for the organisation of transformational finance systems, which is the overarching goal of the Partnership.

These activities include several elements that are integral to the governance system of the any Partnership, enabling for better support of broad stakeholder collaboration. In the case, of the new Partnership FutureFoodS, this in particular includes the provisional support for the organisation of transformational finance systems as overarching goal. A stakeholder analysis was conducted to identify the key actors involved in advancing SFS-education, understand their roles, and uncover gaps in collaboration and alignment. This helps to create a comprehensive understanding of the ecosystem and inform strategies for fostering stronger partnerships and effective action toward sustainability goals.

Various models of (trans)national cooperation and alliances between HERIs exist, and the EC pushes for a Joint European Degree. The legal framework of a European or joint degree, residing under different national legislation, could stimulate this ambition. The binding factor, a European HERI sustainability charter or a code of conduct for SFS education should be prepared to help guide HERI's collaborative activities, align approaches and use best practices from leaders of change (top universities) to create knowledge and practical solutions for modern food systems that could support the Partnership in activating the academia, industry and society to collaborate.

The discussion in the report seeks to answer the question how to understand and operationalise the concept of a branded network of exemplary university-driven local food ecosystems. We point out that it is a system of university-driven collaborations (rather than an additional network understood as a formal body or association) developing a more actuarial, SFS-oriented curriculum, an improved accreditation system, with their clearly defined objectives - enshrined in the food systems sustainability charter - elaborated in a code of conduct. Therefore, we investigate what is needed at the University level to design modern, innovative, SFS-oriented curricula that are attractive to students and industry, in which direction should the system of accreditation of destinations evolve to drive change towards SFS.

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We demonstrate that a sustainability charter helps an organisation achieve its goals by providing a framework for strategic decision making within a collaborative network, we also analyse how a Code of Conduct should be developed to support the process of integration and cooperation of universities in teaching and activities promoting the SFS approach. Finally, we point out recommendations on how the knowledge and experience gathered in the consortium can be put into practice, with the participation of the experts surveyed, workshop and conference participants, so that the concept of improving the organisation of the education system is in line with the state of the art and the conceptual approach to shaping modern and innovative food systems.

1. Introduction

The overall goal of the FOODPathS project is to prepare a 'Prototype P-SFS for people, planet and climate'. The vision of the Partnership is to collectively achieve healthy, safe, environmentally friendly, socially secure, fair, and economically viable food systems for Europe. This can only happen if it succeeds in mobilising individuals, actors and networks representing R&I in Europe to accelerate the transition from linear food chains towards circular food systems that function within planetary boundaries.

FOODPathS prepares complementary activities that make up the modus operandi of the Partnership, with proposals for actions that represent solutions to enable the Partnership to have a more efficient and effective impact on the process of transforming food systems. One important element for a good understanding of the Partnership's directions is the Food Systems Strategic Working Group (FS SWG) developed within the Standing Committee on Agricultural Research (SCAR), with the support of FOODPathS, the SRIA, SCAR 2023 which serves as the Partnership's backbone, with the goal of identifying key levers of change to be implemented across Europe, considering social, economic, and environmental factors.

Whereas the premise is that FOODPathS will accompany the future Partnership at its start by providing recommendations, (digital) tools, proposals of protocols and a dedicated multi-level, inclusive, governance model, this report contributes with an **branded network of exemplary university-driven local food ecosystems**.

This deliverable builds upon the mapping of programs and universities that was executed under D5.1 (‘Assessed skills and knowledge gaps’ (FOODPathS, 2024)), of which the two major recommendations included participatory and collaborative approach (ie. Living Labs) in education programs to experiment with different actors and scholars is requested to be a key attention point of the future partnership and applying the Pact4Skills model to universities organisation. This approach could help to integrate the national, regional, and local authorities with different stakeholders, as companies, social partners, cross-industry and sectoral organizations, chambers of commerce, education and training providers, and employment services to work together. We believe that the variety of stakeholders could contribute to curriculum planning (what is needed), teaching (including site visits), and campus life. A strong cooperation with the Pact4skills program is considered a must for the future Partnership. This was a starting point for considering and possible organisation of the university as a leader in food systems change and became the basis for considering the concept of **branded networks**, their possible **sustainability charter** and **code of conduct**.

In the practical dimension of this approach, we build on the four key area's developed in FOODPathS (D5.1) identified as systemic solution that enable HERIs to act as catalysts for SFS transformations:

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- Curriculum Development: Designing interdisciplinary and experiential learning opportunities that integrate the economic, social, and environmental dimensions of food systems at all education levels.
- Campus Operations: Embedding sustainable practices in food procurement, waste management, and infrastructure to model sustainability in action.
- Community Engagement: Building partnerships with local stakeholders, including industry and policymakers, to align education and research efforts with real-world sustainability challenges.
- Research and Innovation Partnerships: Strengthening ties between academia and industry to foster knowledge transfer and co-develop innovative solutions.

The Objective

The aim of the work presented in the deliverable is analysis and discussing a concept for a branded network of university-driven ecosystems, based on a sustainability charter and code of conduct. This should contribute to a better understanding of how universities can act as catalysts for food systems transformation, and their roles within broader stakeholder ecosystems. The primary target audiences include partnerships such as FutureFoodS, or any other actor involved in university-driven ecosystems, like, the European Commission DG RTD, SCAR SWG FS, R&I stakeholders, industry players, policymakers (at local to global scales), philanthropic organisations, and students. Finally, it outlines an action plan with the identification of institutions that can well address the problem of building a network of knowledge and education practices, with the important participation of the Partnership.

Specific objectives	Approach
The concept of the Branded Network of Universities	• Desk research on governance structures • Mechanisms for collaboration among universities and networks • Interviews • Survey • Expert workshops (exchange with stakeholders in consortium and EFFoST conference)
Curricula and accreditation	• Desk research on existing models • Conclusion • Survey • Interviews • Discussion with experts • Expert recommendations
Proposal for a Food Systems Sustainability Charter	• Desk research and review of 25 charters • Survey • Interviews • Expert workshops
Code of conduct	• Desk research on existing approaches • Expert workshops • Synthesis and expert recommendations
Recommendations for the Partnership	• Validation of findings • Internal review • Discussion sessions • ExCom review

TABLE 1 – SPECIFIC OBJECTIVES OF D5.2 AND METHODOLOGIES USED TO REACH THEM

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The research base of this deliverable followed the specific objectives listed in Table 1, and counted with the expertise and experience of FOODPathS partners and organizations collaborating with the project, complemented by desk research, interviews, surveys, workshops and critical analysis and inference.

FOODPathS brings together expertise and experience of 17 partners across Europe from funding organisations, public institutions, academia, research and education organisations, private and farming sectors (including SMEs), philanthropic organisations, NGOs, and non-profit organisations. They all represent networks of potential co-funders, regional and, local policy makers, universities, private parties and farmers, consumers and civil society. Their expertise together with the aforementioned experience of the representatives of the organisations systematically collaborating under the coherent methodological approach of this project, in collaboration with the SCAR FS SWG, were of great value to synthesize knowledge and evaluate new solutions to better understand and support the transformation of SFS. Collaborative meetings served as a critical platform to test and refine these recommendations, ensuring they align with stakeholder priorities and the broader vision for SFS.

The results of the actions implemented were critically analysed in order to develop recommendations, through a process of collaboration within the consortium, that will serve to better guide the Partnership towards the possibility of supporting the collaboration of top universities for the creation of new educational foundations, campus organisation, cooperation with the environment (including industry in particular) for the training of a modern cadre of innovators for SFS.

2. Mapping of stakeholders and their needs towards education

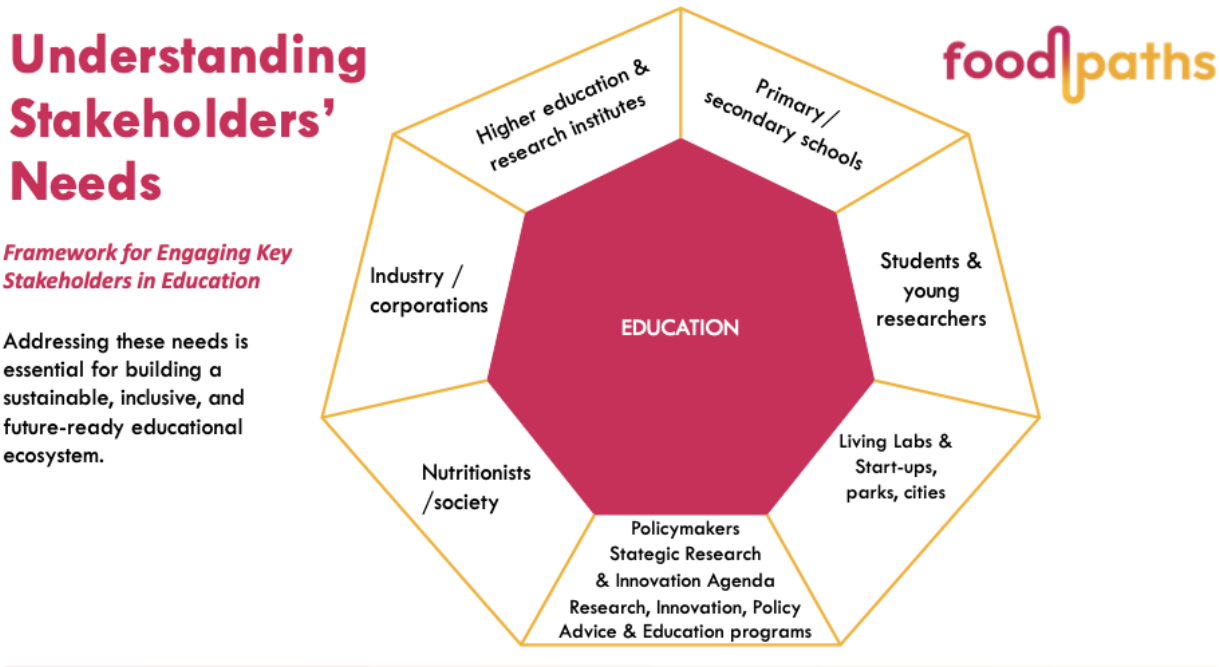

FIGURE 1 THE RELEVANT STAKEHOLDERS FOR FUTURE EDUCATION PROGRAMS ON SFS, AND UNDERSTANDING THEIR NEEDS. (DESIGN: VERSTEEG AND CHMIELINSKI)

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HERIs play a pivotal role in driving SFS transitions by serving as hubs for knowledge generation, innovation, and advanced training. These institutions shape the expertise and understanding required to tackle complex challenges in food systems, equipping students, researchers, and professionals with the tools to innovate and lead transformative efforts.

The involvement of various stakeholders in education programs is crucial. To build sustainable, inclusive, and future-ready educational ecosystems, it is necessary to understand stakeholders' needs and align curricula accordingly.

Primary and secondary schools are equally essential, providing the foundational knowledge about food systems, sustainability, and nutrition that young learners need. Early education in these areas prepares students to understand the interconnectedness of food, health, and the environment, fostering a generation more aware and equipped to engage with these critical issues in the future.

Students and young researchers represent the next wave of innovators, decision-makers, and leaders who will drive change in food systems. Through their studies and practical applications, they contribute fresh ideas, energy, and perspectives that are crucial for building sustainable practices and addressing emerging challenges.

Industry and corporate partners are key stakeholders in the transition to SFS. They drive innovation and market shifts while requiring a skilled workforce capable of addressing the demands of a rapidly evolving sector. Collaboration with educational institutions and researchers ensures that their practices and products contribute positively to sustainability goals.

Living labs, start-ups, and urban environments serve as dynamic testing grounds for innovative solutions and community engagement strategies. These spaces allow stakeholders to experiment with real-world applications of sustainable practices, fostering collaboration between academia, industry, and society to co-create viable and scalable solutions.

Policymakers are indispensable in shaping the frameworks that enable and support SFS. Their influence extends across research, education, and industry practices, guiding the development and implementation of policies that align with sustainability goals. By providing direction and resources, they facilitate the systemic changes needed to achieve lasting impacts.

Nutritionists and societal organizations advocate for health and well-being as integral components of SFS. Their work highlights the critical role of nutrition education, emphasizing the need to align dietary practices with environmental sustainability while ensuring public health objectives are met.

Together, these diverse actors form an interconnected ecosystem, each contributing to the advancement of SFS through their unique roles and expertise. By fostering collaboration among these stakeholders, we can accelerate the transition to a food system that meets the needs of both people and the planet.

Despite the importance of collaboration, many stakeholders still operate in silos, such as separate Food and Health educational programs or governmental departments. Strengthening the interconnections between these actors is essential to maximizing the impact of SFS initiatives. Addressing this gap requires stronger collaboration between academia and industry to ensure that curricula reflect real-world challenges and future workforce needs.

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The development of a sustainability charter for SFS education, promoted through the SFS Partnership, is a key step in supporting these practices, and can catalyze these interactions.

Outcomes of several workshops[1], webinars, and individual interviews however identified a gap between the needs of the industry and the educational programs offered. Universities are either public or private entities that are confronted with societal challenges and market demands. The students are partly led by societal considerations and by the labor market in their choice of study and university. The mentioned "university ecosystem" is therefore not a stand-alone operating factor. It should be seen with multiple other stakeholders.

The same goes for the relation between HERI and instance policymakers and/or civil society. Contrary to the interlinkage between stakeholders in e.g. sustainability-oriented initiatives, we also identified that many of these actors work in silos (for instance Food and Health educational programs and/or governmental departments). These interactions may become an essential part of the success factor of the actual catalyze function of the branded network and need extra mapping with the support of future Partnerships.

HERIs, as independent entities, shape their curricula and sustainability practices based on several factors embedded in their development strategy. Therefore, implementing the principles of SFS requires a systems approach that identifies the benefits of the transformation. These may relate to opportunities for collaboration, exchange of staff and students, or financial support for specific practices. These practices will be developed in the food systems sustainability charter that will be promoted in the SFS Partnership and are suggested to receive strong support.

The Special Session Stakeholder *debate on educational needs toward food systems transition,* held at the EFFoST Conference on November 12, 2024 with 13 participants representing stakeholders like academia, industry, and student representatives, focused on transforming education to support SFS. The 1,5 hour debate gave very specific and concrete insights in the needs, obstacles and recommendations from the stakeholders towards the educational system.

The data obtained at the workshop suggest that universities should be supported in developing innovative and collaborative curricula focused on SFS. This includes integrating sustainability topics at all education levels, from undergraduate to PhD and postdoctoral programs, and introducing interdisciplinary modules that address the economic, social, and environmental impacts of food systems. To complement traditional education and address industry knowledge gaps, micro-credentials can be developed. Inter-university collaboration should be encouraged to create comprehensive curricula, alongside initiatives such as competitions to foster creativity and interdisciplinary thinking. Project-based learning should be implemented to bridge the gap between academia and industry, while discussions on environmental impact and sustainability should be incorporated into lab work and courses. Workshops on sustainable lab practices

[1] Seinajoki, Finland, June 11 2024: Workshop " how to align HERI and industry"? 9 participants
FOODPathS Webinar October 22, 2024: How can education support a sustainable and healthy food system?
Stakeholder debate on educational needs toward food systems transition**,** EFFoST2024 Conference, Bruges, Belgium, November 12, 2024. 13 participants (students, HERI and industry representatives)
FOODPathS closed workshop: potential and challenges in scaling up modern food technologies, EFFoST2024 Conference, Bruges, Belgium, November 13, 2024, 14 participants (HERI and industry representatives)
EHEDG Conference Nantes, France October 2-3, 2024, interviews with participants
Interviews with Wageningen University & Research Projectmanager Value Creation / Teammanager Knowledge for Society and Wageningen University & Research Chair Board of Continuing Education

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and alternatives can further raise awareness, and a dedicated task force can be established to drive the integration of food systems and lab transformation topics into academic programs.

For this, support from policymakers is needed; they play a key role in advancing sustainability by improving accreditation systems to help universities adapt quickly to business and sustainability needs, including fast-tracking new curricula. They should also establish clear, standardized guidelines to make sustainability metric reporting mandatory for industries and the industry should adopt mandatory sustainability metric reporting through standardized guidelines to ensure accountability and transparency. Additionally, policymakers should promote public awareness and engagement by effectively communicating the importance of sustainability, fostering broader societal support for sustainable practices.

Encouraging project-based learning in universities can strengthen collaboration between industry and academia, helping to bridge the gap between academic knowledge and industry needs.

Additionally, research and innovation initiatives, such as sharing the reverse incubator methodology[2], can facilitate knowledge transfer and foster collaboration between stakeholders. (see figure 2)

FIGURE 2 - REVERSE INCUBATOR METHODOLOGY (DESIGN ASKFOOD)

An elaborate transcript of the debate can be found in ANNEX II.

Through collaboration with the Good Food Institute, EFFoST invited 12 high-level expert speakers from various organizations to reflect on the potential and challenges in scaling up modern food technologies. During the FOODPathS closed workshop: potential and challenges in scaling up modern food technologies (like Precision Fermentation and Cellular Agriculture), held at EFFoST2024 Conference, Bruges, Belgium, on November 13, 2024, the session focused on the following 3 questions:

1. Which R&D and scaling challenges must modern food technologies like Precision Fermentation and Cellular Agriculture overcome to hit key disruption points?

[2] The Reversed Incubator is an innovative methodological approach aiming at inverting the logic with which we transform ideas into new businesses and companies. It combines training with entrepreneurial opportunities and concrete ideas to generate innovation in food-related sectors. https://www.askfood.eu/reversed-incubator-0

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2. What bottlenecks prevent the academic and commercial research ecosystem from addressing these challenges - funding, knowledge, and collaboration access? How can we address this?
3. How can other actors (such as policymakers, investors, businesses, and civil society) contribute to accelerating the adoption of precision fermentation and cellular agriculture?

The main conclusion was that the success of modern food technologies not only depends on solving technological, regulatory, and societal challenges. Talent shortages in the SFS transition was mentioned as an important future barrier, which should be tackled urgently by improving the SFS education context. See ANNEX III for full text.

3. Network of universities

A network of universities as core of the ecosystem, or a network of universities forming the ecosystem?

At the start of the project, the partners in WP5, but also the partners in the other WP's, had several meetings on what the definition of the words "branded" "network of universities" and "local food ecosystems" could imply or enhance and how they could relate to each other.

For instance the discussion on what "branded" implies, focused on the creation of a branded network that aims to provide a collaborative and impactful platform for universities to engage in sustainability initiatives, offering them a unified voice and the opportunity to contribute meaningfully. A key recommendation was to establish a new network that either integrates with existing associations or stands alone, allowing universities the flexibility to participate in sustainability efforts. Starting with universities selected through rankings provides a strong foundation for the network. Additionally, the analysis of the assumptions of another Horizon Europe project called FOSSNET[3] highlights the need for content development and leadership in sustainability, which aligns with the goals of the branded network. The branded network should position universities as leaders of change, with an emphasis on fostering partnerships, sharing expert knowledge, and integrating into the broader partnership ecosystem through the knowledge hub and observatory. It is important that the network remains voluntary and complementary to its partner institutions, ensuring it provides value without replacing existing structures. The inclusion of highly motivated universities, particularly those already active in sustainability or committed to SFS, will contribute to the success of the network. Finally, the network should continuously evolve to meet the dynamic needs of higher education, incorporating regular updates to key documents, including the SRIA, and promoting lifelong learning through various offerings. By fostering collaboration and innovation, the branded network can lead the way in advancing sustainability across higher education institutions.

In order to get a clearer picture of the current role the EU HERIs take upon them, and which HERIs could serve as these examplary universities, two actions were taken. First the mapping of universities excercise (which was already done under D5.1 in a limited version) was executed again, this time including additonal search bases. In Deliverable D5.1 a mapping of universities was already done, where 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

[3] https://fossnet.eu/

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Rankings. Since these rankings primarily focus on green campuses and environmental sustainability, this updated version includes additional desk research to identify the leading universities in Europe offering sustainable food education programs, like universities linked to EIT Master in Food systems, FAO Sustainable Food Systems Masters Programme and IFSTAL food-systems thinking.

The universities from the 3 rankings were listed in an excel based on their order of appearance in one or more of the three rankings. The same procedure was done for the universities that resulted from the desk research. With this combined excel we compiled a top 15 of universities, based on the number of times they occurred in both the 3 rankings and the desk research outcomes. These universities can act as example universities to understand the curricula and the role of these universities in food systems education and catalyzer of SFS transformation. This resulted in underneath list of universities (Table 2), which we will regard for our further recommendations as the potential core of exemplary universities.

Combined rankings			
Rank	**name university**	**Country**	**Website**
1.	Ghent University	Belgium	www.ugent.be
2.	University of Turin	Italy	www.unito.it
3.	Reading University	England	www.reading.ac.uk
4.	Aarhus University	Denmark	www.au.dk
5.	University of Cambridge	England	https://www.cam.ac.uk/
6.	University of Edinburgh	Scotland	www.ed.ac.uk
7.	University of Hohenheim	Germany	https://www.uni-hohenheim.de/en
8.	University of Kassel	Germany	www.uni-kassel.de
9.	Lund University	Sweden	www.er.lu.se
10.	Isara Lyon	France	www.isara.fr
11.	University of Manchester	England	https://www.manchester.ac.uk/collaborate/business-engagement/knowledge-exchange/
12.	University of Oxford	England	https://www.oxfordinternational.com/contact-us/
13.	University of Warsaw	Poland	www.uw.edu.pl
14.	Wageningen University and Research	Netherlands	https://www.wur.nl/
15.	ETH Zurich	Switzerland	www.ethz.ch

TABLE 2 - TOP RANKED UNIVERSITIES FOR SFS TRANSFORMATION (OWN STUDY)

Additionally a survey and individual interviews with representatives of universities and their networks were conducted, to see to what extent and how they understand and drive FS transformation, where are they

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getting their knowledge from, who are they working with, but also what problems are they facing in their activities? The description of the survey and the questions of the survey can be found in ANNEX 1.

As part of Milestone 11 (*Willingness of stakeholders to commit to a branded network of exemplary university sustainability charter*), an analysis of the intention to commit to a sustainability charter was conducted. One of the questions in the survey was whether the universities are open to committing to a common sustainability charter. Seven (out of the 12 responding) universities replied positively. We conducted initial interviews to understand what the motivations of the respective universities are. Two main findings came out of these interviews: (1) the universities that wouldn't match the criteria of being branded as an exemplary university mainly replied positive from their interest to learn from more experienced universities, in particular in the fields of governance, juridical aspects, accreditation process and organisation of campuses (eg. waste management, sustainable procurement, info campaigns for staff and students); (2) the universiites that are better established and better organised, were mainly sceptical in the prospect of another network of universities, and were not immediately motivated to commit to a sustainability charter as part of a network.

Another issue suggested in the responses to the interviews, which might be a good idea to consider, is the introduction of a chief sustainability officer in the organisational structure of the university, dealing with the issues of implementing the principles of a systemic approach and organising the campus according to the developed principles. This would also be the task of the branded network (or leading universities) together with the business representatives and with the participation of the administration, which at the same time would be the holder of the funds (coming from public support schemes - EU or national - for the transformation of food systems). A pilot of such activities could be organised and financed by the Partnership, as part of the implementation of the branded network approach. As this is part of an approach to shaping a good governance model at the university level, in line with the SFS approach that we present in FOODPathS this approach is recommended to be tested as part of the Partnership's activities. This corresponds to the SRIA priority R&I 4 'Change the way we govern food systems'.

Following this outcome, the investigation followed existing collaborations, networks, and programs, to analyse what the current setting is, and how a network of universities could be formed. Through desk research and 1-1 interviews, we found that there is already a large emphasis on internationalisation of education, uniforming the EU education standards, and there are already multiple networks of universities. These are discussed in Chapter 4.

To make a start with the visualization of the network, a name and a logo were developed. For the name we looked at the options including a reference to Food Systems, Education, Sustainability and Network, reflecting the network's dual focus on education and sustainability within food systems., while keeping the dynamic and memorable aspects (see Figure 3).

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FIGURE 3 LOGO ENFUSE

4. Internationalisation: Advancing SFS Education through Collaboration

In the pursuit of SFS, internationalisation emerges as a vital strategy for higher education institutions (HEIs). By fostering inter-university collaboration, institutions can share resources, expertise, and diverse perspectives to develop innovative and interdisciplinary SFS curricula. This collaborative model enables universities to pool strengths and fill gaps, particularly benefiting smaller institutions that may lack standalone SFS programs.

Internationalisation is perceived to be a key factor for modern knowledge- based societies; and has been steadily increasing in importance and scope[4]. Higher education institutions pursue internationalisation as a pro-active strategic issue. Internationalisation of the curriculum and of the teaching and learning process has become increasingly relevant for higher education institutions. Various forms of cross-border education have become widespread. In 2023, the European University Association's (EUA)[5] *Universities and the future of Europe* (UniFE)[6] project gathered and consulted university leadership, national rectors' conferences and university associations, experts and student representatives for wide-ranging discussions on the future of Europe and the HERIs place within it. The report[7] outlines four different future scenarios for transnational university collaboration. These scenarios are not inevitable hypotheses but are intended primarily as a source of reflection for stakeholders in higher education. Two scenarios are optimistic and focus on growth and transformation;

- Growth Scenario: Collaboration between universities is deemed necessary because they cannot tackle global challenges individually.

[4] the Bologna Process aims to create a EHEA with comparable academic degrees, focused on promoting mobility and ensuring the quality of education.
[5] https://www.eua.eu/ is the collective voice of the universities of Europe. For over two decades, EUA has played a key role in building university communities across the whole of Europe, creating a coherent system for European higher education and research. EUA is a community of over 900 members and affiliates. It represents universities and national rectors' conferences in 49 European countries, as well as affiliated organisations and networks based both in and beyond Europe.
[6] https://www.eua.eu/our-work/projects/eua-projects/universities-and-the-future-of-europe-unife.html
[7] https://www.eua.eu/downloads/publications/unife_report_.pdf

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- Transformation Scenario: This envisions a new form of university collaboration at the European federal level. In this scenario, federal European universities are established, with campuses spread across Europe. These federal universities build on the European Universities Initiative (EUI) and are therefore funded by the EU.

In the transformation scenario, looming geopolitical tensions with third countries stimulate EU member states to recognize that innovation and skills development are better addressed collectively at the EU level.

The creation of robust inter-university networks is central to this effort. Such networks facilitate the co-design of curricula that integrate academic, industry, and policy dimensions of SFS. Shared teaching responsibilities, combined with specialization opportunities, empower universities to provide holistic education while reducing individual institutional burdens. These partnerships also pave the way for academic and industry mentorship programs that equip students to become drivers of systemic food system changes. Strengthened ties with potential employers further enhance workforce readiness and align educational outcomes with sustainability goals.

The European Commission, universities, and organizations representing HERIs have increasingly emphasized internationalisation. This trend aligns with cross-border education initiatives and the integration of global perspectives into curricula and teaching methods. As institutions prioritize internationalisation, they urge quality assurance agencies to include this dimension in their assessments. However, consistent methodologies for evaluating internationalisation efforts remain a work in progress.

The Bologna Process exemplifies Europe's efforts to harmonize higher education systems and create the European Higher Education Area (EHEA). This initiative supports academic mobility, quality education, and comparable degrees across countries. While progress has been made, challenges like structural reforms and automatic recognition of qualifications persist. The recent Tirana Communiqué highlights these goals and emphasizes innovative approaches, such as recognizing microcredentials and promoting lifelong learning, to meet global challenges like climate change and digitalization.

Despite legislative obstacles, the European HERI system is steadily moving toward greater internationalisation. By fostering greener, more inclusive, and balanced mobility, the EHEA prioritizes meaningful exchanges between countries. Strengthened international connectivity enhances the collective capacity of universities to address pressing global challenges, including those within the food system.

The internationalisation of higher education, coupled with inter-university collaboration, plays a pivotal role in advancing SFS education. Together, these approaches enable universities to act as catalysts for food system transformation, equipping future leaders with the knowledge and skills to navigate complex global challenges. Through shared efforts, HEIs contribute to building sustainable and resilient food systems for a better future.

4.1 Existing Initiatives Supporting SFS Education

4.1.1 European Degree

The European Degree initiative, introduced as part of the European Commission’s 2022 Communication on a European strategy for universities, aims to simplify the development and implementation of joint degree

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programs. By providing a shared European framework, the initiative seeks to enhance collaboration among universities, enabling them to innovate, attract talent, and offer competitive joint degrees. The framework is voluntary, emphasizing shared European criteria while maintaining the autonomy of national, regional, and institutional degree systems. Despite its promise, challenges remain, particularly in navigating the complexities of multi-institution collaborations. Ten Erasmus+ policy experimentation projects were selected. They started their activities in spring 2023 and ended in spring 2024, with their final reports delivered in summer-autumn 2024. The findings and recommendations on these projects[8] emphasize the need for a more structured, adaptable, and inclusive approach to fostering effective cross-border collaboration in higher education, ensuring both operational simplicity and accessibility for institutions at various levels.

1. **Lack of Legal Framework:** Higher education alliances face significant barriers due to the absence of a clear, adaptable legal framework for supporting transnational collaboration, which complicates joint educational initiatives.
2. **Inadequacy of Current Instruments:** While existing national and EU-level cooperation instruments address certain operational challenges, they do not fully simplify or streamline the process of implementing joint educational activities across institutions.
3. **Value of an EU-Level Instrument:** An enhanced EU-level cooperation instrument could provide substantial advantages by addressing limitations found in national models and offering a more unified approach to cross-border collaboration.
4. **Flexibility:** The dynamic nature of higher education collaboration necessitates flexible EU instruments that can easily adapt to evolving educational needs and collaborative models.
5. **Voluntary Participation:** EU cooperation instruments should support and complement institutions, without mandating compulsory participation, preserving institutional autonomy and ensuring inclusivity.
6. **Access to EU Funding:** Institutionalized cooperation should not be a barrier to accessing EU funding. Higher education alliances should be eligible for programs like Erasmus+ and research and innovation initiatives, regardless of formal cooperation structures.
7. **Potential of Existing Tools:** Instruments such as the European Grouping of Territorial Cooperation (EGTC) and European Economic Interest Grouping (EEIG) have the potential to be refined and adapted to better support higher education collaborations for joint transnational educational activities.

4.1.2 Joint Programs and Degrees

Joint programs, which lead to joint degrees, represent a practical pathway for inter-university collaboration. Developing such programs typically takes around two years and can benefit from guides like the European

[8] The European degree was presented as one of the flagships of the 2022 Commission Communication on a European strategy for universities. As a follow-up, the Commission has published, in 2022, the Erasmus+ call for a European policy experimentation in higher education. The priority here was to support higher education institutions in piloting a European degree label for joint transnational programmes responding to a number of criteria. It was also to test institutionalised cooperation instruments, such as a possible legal status at the European level for alliances of higher education institutions, including the European Universities. As a result of this call for proposals, 10 Erasmus+ policy experimentation projects (hereafter referred to as 'Erasmus+ pilot projects') were selected. They started their activities in spring 2023 and ended in spring 2024, with their final reports delivered in summer-autumn 2024

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Approach for Quality Assurance. These programs exemplify how universities across borders can integrate resources and expertise for specialized education.

EIT Food Master in Food Systems[9]:

This program exemplifies a successful joint initiative, involving academic institutions and industrial partners from EIT Food's pan-European network. It offers students the opportunity to study at three universities, each focusing on distinct aspects of the food system. The curriculum includes academic modules, industry-mentored projects, and a thesis, equipping graduates with in-depth knowledge and skills for food system transformation. Partner institutions include seven universities identified in the mapping exercise of SFS programs (see Chapter 2.1).

IFSTAL (Interactive Food Systems Teaching and Learning)[10]:

A learning community led by Oxford University's Environmental Change Institute, IFSTAL enhances postgraduate education in food systems thinking. It connects students and faculty across five leading institutions through interactive teaching methods, virtual learning environments, and comprehensive research placements. These efforts address workforce needs and strengthen ties with employers.

European Master Food in Studies (EMFS)[11]:

Offered within Wageningen University's Master in Food Technology program, the EMFS is a 25-year-old collaboration between leading European universities. Students benefit from academic modules at four institutions—Wageningen, University College Cork, AgroParisTech, and Lund University—during their first year, followed by a thesis project in collaboration with multinational food industry leaders. Graduates acquire interdisciplinary expertise and practical experience, ensuring global employability in the food industry.

4.1.3 Collaborative Networks

Euroleague for Life Sciences (ELLS)[12]:

A network of leading universities specializing in natural resources, agriculture, life sciences, and food sciences, ELLS promotes joint teaching, student and staff mobility, and quality assurance. Through resource-sharing, ELLS prepares graduates to meet European and international market demands while enhancing the global standing of partner institutions.

VLAG Graduate School[13]:

A multidisciplinary community for PhD researchers, VLAG focuses on biobased, biomolecular, chemical, food, and nutrition sciences. It connects institutions like Wageningen University and national research centers,

[9] https://learning.eitfood.eu/courses/master-in-food-systems
[10] https://www.ifstal.ac.uk/
[11] https://www.eurmscfood.nl/
[12] https://euroleague-study.org/en
[13] https://www.vlaggraduateschool.nl/en.htm

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fostering cutting-edge research and collaboration. Similar multi-disciplinary communities exist in other Member States, like the doctoral schools in France.

FOODforce[14]:

A network of European research organizations in food, nutrition, and health, FOODforce supports initiatives like the Branded Network. Smaller universities, often lacking complete SFS programs, leverage partnerships with larger institutions to offer comprehensive, interdisciplinary curricula. Discussions and stakeholder debates highlight the need for such inter-university collaborations to address educational gaps and encourage creative, systems-based thinking through initiatives like joint programs and competitions.

These initiatives exemplify the transformative potential of international collaboration in higher education, offering models for integrating resources, fostering innovation, and equipping students to lead SFS transitions.

4.1.4 A Portfolio of Courses: Flexible Pathways for Collaborative Education

Another promising pathway for inter-university collaboration is the development of a portfolio of courses offered by individual universities, accessible to students from partner institutions and recognized as elective credits. Compared to joint degree programs, this approach requires fewer administrative processes, making it more agile and responsive to emerging challenges. Such portfolios allow universities to focus on innovative and up-to-date course offerings, enabling rapid adaptation to changing educational needs. Course portfolios have the advantage to provide a flexible and scalable solution for inter-university collaboration, allowing institutions to innovate while minimizing administrative complexity. By sharing courses across institutional borders, universities can quickly adapt to emerging challenges and offer students access to a broader and more diverse range of learning opportunities. This model represents a practical and impactful step toward fostering transdisciplinary learning and addressing global challenges, including those within the food system.

EduXchange - EWUU Alliance[15]

EduXchange[16] is a platform developed by six Dutch universities, grouped into two alliances, to facilitate cross-institutional learning. Students can easily enroll in courses offered by partner universities through the platform, with their results automatically transmitted to their home institution upon completion. Central to this initiative is the goal of fostering societal change through shared knowledge and talent.

One of the alliances, the EWUU partnership (comprising Wageningen University & Research, Eindhoven University of Technology, and Utrecht University), focuses on two key themes: Transdisciplinary Learning and Enabling Inter-Institutional Education. This alliance employs a matrix structure to enhance collaboration and consolidate learning processes.

Key initiatives under Transdisciplinary Learning include:

[14] https://www.foodforcenetwork.eu/
[15] https://ewuu.nl/en/
[16] https://eduxchange.nl/

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- Flexible Innovative Education: Driving innovation in course and program design.
- Lifelong Learning: Developing professional education for both university staff and external learners.
- Educational Research: Advancing knowledge on effective educational practices.

The EWUU alliance has co-developed tools like the Transition Makers Toolbox and the Challenge-Based Learning Platform, promoting diverse learning communities and lifelong learning opportunities. Additionally, grants aligned with the alliance's research agenda support the creation of innovative learning environments. Currently, Wageningen University offers 57 courses on food systems through EduXchange, ranging from 2 to 6 ECTS.
The second alliance, LDE Alliance, includes Leiden University, TU Delft, and Erasmus University Rotterdam. While this collaboration focuses on shared objectives in specific fields, it does not currently emphasize food systems education.

European bioeconomy university (EBU)[17]
EBU is an alliance of the eight leading European universities in the field of bioeconomy, founded with the mission to address the environmental, economic, and societal challenges of the 21st century. This alliance, established in July 2019, fosters a knowledge-based transformation towards sustainability. Education is a core pillar of EBU's mission. Over the past five years, EBU has developed joint educational strategies supported by EU funding, offering programs from Master's and PhD levels to lifelong learning. The aim is to come from the skills demand in the European Bioeconomy and to align bioeconomy curricula across Europe . The current 3 ongoing joint education projects are:

1. Bioeconomy excellence alliance for stimulating innovative and inclusive green transition
2. Fostering Entrepreneurship for a sustainable and innovative BioEconomy
3. New European Bauhaus Academy Alliance

4.1.5 Lifelong Learning Opportunities

Lifelong learning opportunities encompass formal, non-formal, and informal education initiatives that support continuous skill development throughout an individual's life. These opportunities enable people to adapt to changing job markets, engage in personal and professional growth, and address societal challenges. Lifelong learning includes vocational training, adult education, online courses, and other flexible programs tailored to diverse learner needs, ensuring inclusion and accessibility for all.

The Pact for Skills[18] is a European initiative aimed at mobilizing stakeholders to address skill gaps and support upskilling and reskilling efforts. It fosters public-private partnerships to align workforce skills with labor market needs, particularly in sectors undergoing significant transformation, such as the green and digital transitions. The initiative emphasizes lifelong learning, inclusive education, and training to boost employability and economic resilience across Europe.

Micro-credentials are short, targeted qualifications that validate specific skills, knowledge, or competencies acquired through short courses or training programs. They are designed to be flexible, stackable, and accessible, catering to diverse learning needs, including professionals seeking to upskill or reskill. Recognized across borders, micro-credentials align with the European Qualifications Framework, facilitating their

[17] https://www.european-bioeconomy-university.eu/
[18] https://pact-for-skills.ec.europa.eu/index_en

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integration into formal education and labor markets. As micro-credentials specifically aim to meet the needs of professionals seeking lifelong learning opportunities, it particularly involves short-term education, with the amount of study hours involved per course varying from 84 to 840. This comparable to the time investment made for ECTs, ranging from 3 to 30 ECTs per course. Micro-credentials are granted upon successful completion of a course. This includes evidencing mastery of the course content. For example, by way of an exam, paper, or presentation.

Wageningen University is participating in a Dutch Micro-credentials pilot. This pilot focuses on offering accredited education by colleges, schools and universities for professionals, called Edubadge. As a result of this development, WUR can offer Edubadges for courses that lead to a Micro-credential. Both Edubadges and Micro-credentials are issued via the Edubadges Service, that monitors the quality of educational products[19].

Figure 4 expresses how the branded network of universities incorporates other organizations that support e.g. skills developments (like in the EU Pact for Skills initiative and in micro-credentials) emphasizing a specific field within SFS education. Additonally, existing successful examples, such as the above described **EIT Food Master** (interdisciplinary, cross-border education model) **ELLS (**joint teaching, student and staff mobility, and quality assurance), and **EWUU Alliance** (transdisciplinary learning and enabling inter-institutional education through a matrix structure to strengthen collaboration and streamline learning processes) offer replicable models that other institutions can adapt to their unique contexts.

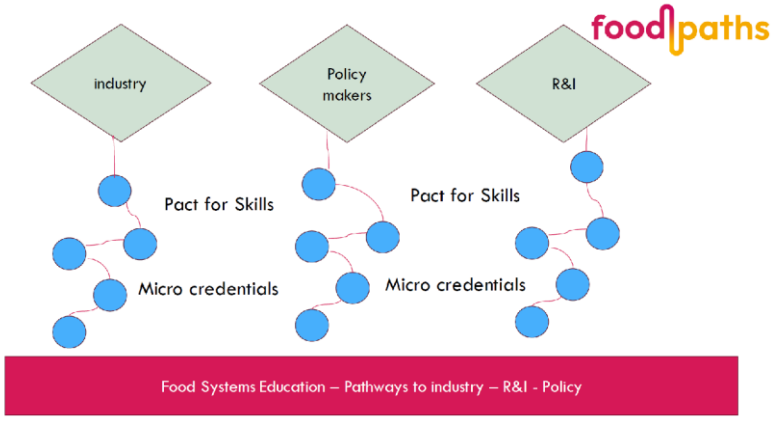

FIGURE 4 POSSIBLE CONNECTIONS BETWEEN ACTORS IN EDUCATION, R&I, AND POLICYMAKING. (DESIGN VERSTEEG AND CHMIELINSKI)

4.2 Agro parcs and living labs

In the deliverable, 4 parcs were mentioned as example of being part of a network. These parcs, which are already in operation and therefore have a well-established structure, developed operating principles and experience, can provide a best practice resource for future cooperation between universities, business and the community within a 'branded network' concept in the form of an SFS virtual parc.

- FICO Eataly, Italy; FICO Eataly World, which opened in Bologna in 2017, closed in February 2024. It whas reopened in 2024 with a new name 'Grand Tour Italia'. The new theme park will take visitors to every region of Italy and the products that region produces. The new setup will be better thought

[19] https://www.surf.nl/en/services/edubadges?dst=n5050

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out and coordinated than FICO in the past, which clearly did not meet expectations.The parkparc offers free education/courses for school children.
No involvement of Bologna university was founduniversity found.

- World Food Center, Netherlands with the affiliated university WUR
- Agropolis, France; They are interesting to contact https://www.agropolis.fr/Who-we-are https://www.agropolis.fr/Notre-equipe. no affiliated university.
- Agro Food Park, Denmark https://www.agrofoodpark.com/about-agro-food-park/, mainly companies. We can contact them to ask if they collaborate with universities.

It is not possible here to detail the governance approach and practical functioning of such a (virtual) parc. It is applicable as a collaborative platform developed from the bottom up by leading food systems universities to maximise the involvement of actors, resources and knowledge.

Further practical recommendations in this respect are provided by the results of the analysis of SFS Living Labs and Knowledge Hubs which were developed by FOODPathS and presented in other deliverables (D2.1, D4.1 and D4.2).

5. Curricula and accreditation

5.1 Curricula

One important element of the branded network concept is to consider to the fundamental role of universities in shaping their curricula. Using material from the desk research, but also from the workshops, which helped us to define the approach and needs of universities to support educational activities in line with the SFS principals, we obtained conclusions that will help shape the process of changing the approach in the development of educational programmes[20], in the current system. Integral to these considerations is also the need to transform the accreditation system to enable better communication between the industry, HERI and the administration in terms of a flexible approach to education to enable the aforementioned transformation[21]. Since given autonomy of HERI (universitites) provides the freedom to develop an approach to arrange and then promote studies to their target audiences, the most important challenge identified involves the process of encouraging them to work together (using their best experiences) to develop common training principles based on best practice in the application of the SFS approach, and taking into account the needs of the industry and the perspective and ambitions of future students (which determine the attractiveness of studies).

We have found that process is lengthy and highly formalised, which helps to maintain rigour regarding the content and quality of the curricula, but at the same time is a barrier to universities changing their curricula quickly (implementing innovative curricula). This stands in the way of taking better account of the latest research findings regarding labour market needs.

[20] van Damme, D. (2009). The search for accountability and transparency: Accreditation, quality assurance and recognition of qualifications in Europe. Quality in Higher Education, 15(3), 249–261.
[21] See: Curaj, A., Matei, L., Pricopie, R., Salmi, J., & Scott, P. (Eds.) (2015). The European Higher Education Area: Between Critical Reflections and Future Policies. Springer.

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In chapter 3 we described the many initiatves on EU transnational level for collaboration on SFS education. In this chapter, we describe the principles of accreditation of research programmes. The understanding of the system will help guide changes in how universities work with the accreditation body. In this context, we see the need for top-down variables, as part of the internationalisation process of the education system[22]. This helps creating a unified approach for the process of improving the accreditation system. Again, as universities have the autonomy and freedom to shape their curricula, and the accreditation system allows for objective evaluation of these curricula, then joint activities should be undertaken between academic units, the accreditation body with the participation of industry and students. his process should be supported via funding through the Partnership.

Following this trend of internationalisation as described in Chapter 4, HERI and programmes asked quality assurance agencies to include internationalisation in their assessment. A consistent, qualitative methodology was however not available.

Internationalisation is a complex phenomenon and is strongly influenced by the context in which it takes places. As a multidimensional concept, the realisation of internationalisation strategies widely varies in different higher education settings[23]. This means that the context and the varied ways in which it is operationalised need to be taken into account when assessing the level of internationalisation.

Sustainability in EU education

One of the recent Eurydice reports is related to sustainability in the EU education system entitled "Learning for sustainability in Europe: Building competences and supporting teachers and schools". The report focuses on primary and general secondary education. It shows the key elements of the general sustainability competences. In the report sustainability education is defined as "a broad concept encompassing ecological, economic and social dimensions. (…), learning for sustainability is based on the values of justice, equity, tolerance, responsibility and respect and, while it promotes environmental protection and sustainable development, it also endorses gender equality, social cohesion, poverty reduction, democracy and welfare"[24].

Within the EU a competence framework in relation to sustainability has already been established – GreenComp[25]. It is the European sustainability competence framework. Within this framework the necessary competences are divided based on the phases of implementation of green solutions:

1. Embodying sustainability values:
    a. Valuing sustainability.
    b. Supporting fairness.
    c. Promoting nature.
2. Embracing complexity in sustainability:

[22] Knight, J. (2015). Internationalization: Concepts, complexities and challenges. In A. Curaj, L. Matei, R. Pricopie, J. Salmi, & P. Scott (Eds.), The European Higher Education Area (pp. 3–19). Springer.
[23] Enders, J. (2004). Higher education, internationalisation, and the nation-state: Recent developments and challenges to governance theory. Higher Education, 47(3), 361–382; and: Beelen, J., & Jones, E. (2015). Redefining internationalization at home. In A. Curaj, L. Matei, R. Pricopie, J. Salmi, & P. Scott (Eds.), The European Higher Education Area. 59–72
[24] European Commission / EACEA / Eurydice, 2024. The European Higher Education Area in 2024: Bologna Process Implementation Report. Luxembourg: Publications Office of the European Union. p. 30
[25] See: Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp—The European sustainability competence framework. Publications Office of the European Union.

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   a. Systems thinking.
   b. Critical thinking.
   c. Problem framing.
3. Envisioning sustainable futures:
   a. Futures literacy.
   b. Adaptability.
   c. Exploratory thinking.
4. Acting for sustainability:
   a. Political agency.
   b. Collective action.
   c. Individual initiative.

These competences should be translated into the needs related to transition to SFS requiring changes in:

- Eating;
- Processing and supplying food;
- Connecting in food systems;
- Governing food systems.

From the set of key competences for sustainability as well as from the perspective of the transition to SFS it is clear that in all the above mentioned areas of food system transformation the tertiary education institutions have to offer curricula enabling knowledge gathering, skill acquiring and attitude's shaping programmes. They should be build around the core competences and enabled by cooperation with all the key stakeholders within the food systems. They should also be based on the values related to all the dimensions of sustainability.

5.2 Accreditation; tools and policies

European Higher Education Area (EHEA)

As already aexplained in chapter 4, EHEA is a voluntary intergovernmental process, built on the Bologna Process, through which its members and consultative members jointly develop policies and soft-law commitments. These are adopted by the competent public authorities of its Member States and implemented within each education system, in collaboration and consultation with the representatives of the higher education community, institutions, students and staff. These Rules of Procedure are to guide the operations of the EHEA in the light of established policies, processes and practices[26]. Ministers identify the policy areas and measures through the declarations and Communiqués they adopt at their regular Ministerial Conferences or in any other setting. They may decide to establish frameworks, standards, guidelines, and other mechanisms to further and ensure implementation through coordination, cooperation and mutual support at European level.

[26] Bengtsson, E. (2018). Quality assurance in the EHEA: The Bologna Process in practice. European Journal of Education, 53(4), p. 545.

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The Bologna Process is continued with the Bologna Follow-Up Groups working on the new challenges and deepening the cooperation within the EHEA to further increase student mobility and mutual recognition of the curricula and other processes related to higher education.

As the national education systems in the European Member States vary significantly, a special network was created by the European Commission and the Member States, to support the interested stakeholders in getting the needed knowledge and comparing the rules at member state level called Eurydice[27]; a network whose task it is to explain how education systems are organised in Europe and how they work. They publish descriptions of national education systems, comparative studies devoted to specific topics, indicators and statistics in the field of education.

The European Association for Quality Assurance in Higher Education (ENQA):

A vital part of the EHEA is quality assurance. The European Association for Quality Assurance in Higher Education (ENQA)[28] is a membership association of quality assurance organisations in the European Higher Education Area (EHEA) that operate in line with the Standards and Guidelines for Quality Assurance in the EHEA (the ESG). Together with other key stakeholder bodies ENQA periodically elaborates standards and guidelines to support the quality assurance system. They include standards for:

- Internal quality assurance;
- External quality assurance; and
- Quality assurance agencies.

The Accreditation system for tertiary education in the EU includes both public and non-public bodies dealing with quality assurance. The first requirement in the accreditation and quality assurance processes for the tertiary education bodies is the existence of transparent and effective internal system of designing, implementing and evaluating teaching programmes. These should ensure meeting the intended learning outcomes and are compatible with the EHEA framework for qualifications stating the minimum number of the ECTS credits to be achieved by the students within each cycle.

The national accreditation and quality assurance bodies within the EHEA are subject to periodic reviews by external bodies. The external reviews for national agencies are conducted by the ENQA and they are a prerequisite to become a member of this organisation. To be listed in the ENQA Register the quality assurance agencies need to undergo such a review.

The tertiary education institutions in the EU obtain a significant level of autonomy in shaping, among others, their curricula. However, to ensure compatibility and mutual recognition there are certain standards to be observed within the Bologna process including a clear presentation of the competences to be acquired during the study process at each study cycle within a given curriculum.

For different domains of the research and science disciplines international university networks and their associations have been created to discuss the curricula and the changes within them to ensure up-to-date teaching and mutual recognition.

[27] https://eurydice.eacea.ec.europa.eu/
[28] https://www.enqa.eu/wp-content/uploads/ENQA-briefing-note_Bolgona-Process_March-2024.pdf

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The European Consortium for Accreditation in higher education (ECA):

The European Consortium for Accreditation in higher education (ECA) is an association of recognised accreditation and quality assurance agencies in Europe[29]. ECA currently has 17 members from 10 countries. All members are quality assurance agencies in EHEA countries that undertake accreditation or accreditation-like procedures. Quality Assurence agencies and other organisations outside the EHEA (or agencies from EHEA that do not fulfil all membership criteria yet) can participate as observers, if decided so by the Board. At the moment ECA has 3 observers from 3 countries.

Based on these observations, the members and partners of the ECA have developed the CeQuint methodology to assess the quality of internationalisation.

The CeQuInt methodology can be used to assess the quality of internationalisation at programme- or at institutional level. A successful assessment leads to the award of the ECA Certificate for Quality in Internationalisation. This Certificate confirms that a programme or an institution has successfully incorporated an international and intercultural dimension into the purpose, function and delivery of its education. Cequint's internationalisation platform provides information on making the quality of internationalisation tangible. It offers programmes and institutions the means to self-assess internationalisation and/or to have their internationalisation assessed by a quality assurance agency. In addition, this is a platform to share and learn from good practices. This methodology tested in twelve countries is the first to assess the quality of internationalisation in compliance with current international quality assurance practices.

The methodology has been developed within the Erasmus+ project CeQuInt. The project consortium was composed of 14 partners from 11 countries, consisting of quality assurance agencies from Austria, Belgium (Flanders), Croatia, Germany (2), Finland, France (2), the Netherlands, Poland, Slovenia and Spain (2), the Academic Cooperation Association (ACA) and the German Academic Exchange Service (DAAD).

None of the issued Certificates for Quality in Internationalisation are in SFS education. It is strongly recommended to change this. At planetary scale, the overall global food system should respect planetary and societal limits. However, the global food system is the construct of many different, interacting, food systems. They may operate at small scale, like urban food systems, or larger scale, like cross-border food systems. All these food systems face the same planetary limits, but potentially different societal and local-environmental limits. Consequently, SFS education needs to take into account the international but also the local dimensions. This is why internationalization is so important to consider here.

ENQA of Joint Programmes

The ENQA of Joint Programmes offers a solution to the various national accreditation requirements. Under the ENQA of Joint Programmes, a single quality assessment will suffice for programmes to obtain accreditation in all the countries of the EHEA in which programme accreditation is mandatory. In many cases, national programmes that are being taught in collaboration with one or more institutions in other countries are faced with different national accreditation requirements. This hampers the development of joint programmes, whereas such programmes are desirable in the purview of internationalization, as we have

[29] https://ecahe.eu/

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described above. For this reason, European partners have been working on solutions for more than ten years now. An example is the ECA project JOQAR[30], which has contributed greatly to a European solution. This solution consists of the ENQA of Joint Programmes, which was adopted by the Ministers of the EHEA in May 2015. This European approach comprises a single framework with standards and procedures for the assessment of international joint programmes. Such joint programmes, which are taught by institutions in several countries, may carry either a single joint degree or several national degrees. This framework enables all the quality assurance agencies included on the European Register to assess joint programmes. The Ministers have agreed that the outcomes of assessments conducted on the basis of the European framework will be recognised in all the countries of the EHEA.

5. Sustainability charter

The sustainability charter is prepared by organizations to outline their commitment to sustainability practices and to guide their decision-making processes. Sustainability, in its essence, encompasses the coordinated and harmonious pursuit of economic, environmental, and social well-being, as outlined in the "triple bottom line" framework that is a holistic approach that considers the long-term impacts of an organization's activities on the planet, its people, and its profits[31].

Analysis of charters by universities and other organizations reveals a multifaceted approach to sustainability, encompassing various initiatives such as the use of renewable energy, recycling, and community engagement[32].

A review of existing sustainability charters of universities and organisations allows pointing to the main elements and rules for writing a sustainability charter[33]. These are:

1. A vision and mission statement outlining the organization's commitment to sustainability.
2. Specific goals and targets across the economic, environmental, and social domains.
3. Concrete action plans and initiatives to achieve these goals.
4. Strategies for stakeholder engagement and collaboration.
5. Mechanisms for monitoring, reporting, and continuous improvement.
6. Alignment with broader sustainability frameworks and industry best practices.

Embedding sustainability within the organizational structure and governance is crucial for translating the charter into meaningful action.

[30] JOQAR was a European project aimed at improving the quality assurance and recognition of joint programs offered by multiple institutions across borders. It tackled the challenges of quality assurance in joint programs, particularly with regard to accreditation processes in different countries and ensuring mutual recognition of degrees. The project developed a framework and good practices for external quality assurance of joint programs, ensuring that such programs meet consistent and high standards. JOQAR was a project with specific deliverables and is no longer active as a project, but its outcomes are still influential in shaping policies.

[31] Sánchez-Flores, R. B., Cruz-Sotelo, S. E., Ojeda-Benítez, S., & Ramírez-Barreto, Ma. E. (2020). Sustainable Supply Chain Management - A Literature Review on Emerging Economies, Sustainability 12, Issue 17, p. 6962. And: Presley, A., Meade, L., & Sarkis, J. (2007). A strategic sustainability justification methodology for organizational decisions: a reverse logistics illustration. In A. Presley, L. Meade, & J. Sarkis, International Journal of Production Research Vol. 45, Issue 18. https://doi.org/10.1080/00207540701440220

[32] Hasim, M. S., Hashim, A. E., Ariff, N. R. M., Sapeciay, Z., & Abdullah, A. (2018). Commitment to sustainability: A content analysis of website for university organisations. In M. S. Hasim, A. E. Hashim, N. R. M. Ariff, Z. Sapeciay, & A. Abdullah, IOP Conference Series Earth and Environmental Science Vol. 117, p. 12046. https://doi.org/10.1088/1755-1315/117/1/012046

[33] Hasim, M. S., Hashim, A. E., Ariff, N. R. M., Sapeciay, Z., & Abdullah, A. (2018). Op cit. 1245

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The food systems sustainability charter should include[34]:

- Sourcing food from local and organic producers, which can reduce the environmental impact of transportation and support local economies while promoting healthier and more sustainable agricultural practices.
- Minimizing food waste through initiatives such as food donation, composting, and optimization of ordering and storage.
- Adoption of sustainable dining practices like using reusable dishware, energy-efficient equipment, and environmentally-friendly cleaning products.)
- Engaging with students, faculty, and staff to raise awareness and foster a culture of sustainability.
- Establishing partnerships with local organizations and communities to support sustainability initiatives[35].
- Implementing a comprehensive monitoring and reporting system to track progress and continuously improve sustainability performance.

The development and implementation of a comprehensive sustainability charter can position an organisation as a leader in sustainable practices, enhancing its reputation, reducing its environmental and social liabilities, and potentially increasing its operational efficiency[36].

Sustainability charters can be particularly impactful in the context of higher education institutions. As centres of learning and research, universities have a unique opportunity and responsibility to develop the knowledge, technologies, and tools necessary to create a more sustainable future[37]. By embedding sustainability within their operations, universities can serve as models and catalysts for broader societal transformation.

For the definition of the content of the food systems sustainability charter, the results of the analyses were collated covering (1) the approaches presented so far in universities, university networks, but also in business (25 different charters were analysed) and a (2) defined action plan in 4 areas of SRIA of the Partnerships (described below) and (3) findings from the survey and workshops.

The structure of the charter naturally follows work prepared by the SCAR FS SWG in close collaboration with FOODPathS. It resulted in Strategic Research and Innovation Agenda (SRIA) for the 'Sustainable Food Systems Partnership for People, Planet and Climate (SRIA, 2023). herein it is it stressed that Partnership Prototype should include a: "Vision & sustainable value creation & sustainability chart, addressing sustainability consequently from the three dimensions (environmental, social and economic)". The following key elements are suggested to be incorporated in the Prototype, including recommendations based on our findings:

- R&I 1 'Change the way we eat'
- R&I 2 'Change the way we process and supply food'
- R&I 3 'Change the way we connect with food systems'
- R&I 4 'Change the way we govern food systems'

[34] Kumar, V., Rahman, Z., & Kazmi, A. A. (2013). Sustainability Marketing Strategy: An Analysis of Recent Literature. In V. Kumar, Z. Rahman, & A. A. Kazmi, Global Business Review, Vol. 14, Issue 4, p. 601 https://doi.org/10.1177/0972150913501598.
[35] Our focus on university-driven ecosystems is in line with this point.
[36] Shriberg, M. (2000). Sustainability management in campus housing. International Journal of Sustainability in Higher Education Vol. 1, Issue 2, p. 137. https://doi.org/10.1108/1467630010371885
[37] Shriberg, M. (2002). Toward sustainable management: the University of Michigan Housing Division's approach. Journal of Cleaner Production Vol. 10, Issue 1, p. 41. https://doi.org/10.1016/s0959-6526(01)00021-x

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These R&I efforts in the above-mentioned thematic R&I Areas will be achieved through the four interconnected activities:

- Pooling R&I resources and programming, with a particular focus on co-funding mechanisms for projects based on food systems approaches;
- Launching a food systems observatory, with the ambition to monitor efforts on the sustainability performance of EU food systems and their progress towards sustainability goals;
- Establishing a food systems knowledge hub, including a network of transformative research and innovation Food System labs (FS-Labs) on systemic innovations at different scale;
- Knowledge sharing and scaling, adapting knowledge systems, innovation platforms and sciencepolicy interfaces, aiming to facilitate all of the FS actors to understand the complexity of food systems, to follow FS approaches and transformations, to align R&I interests and to exploit synergies in an open access manner.

The consensus is laid down in the SRIA of the P-SFS:

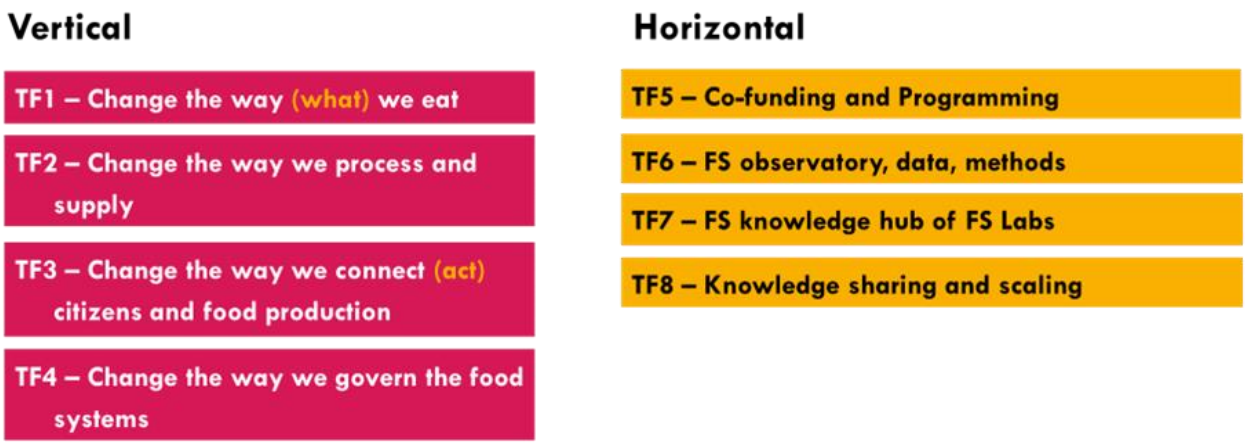

FIGURE 5 THE FOUR THEMATIC R&I AREAS AND FOUR TRANSVERSAL ACTION THEMES (SRIA OF THE P-SFS, SCAR, 2023)

Based on the SRIA we can point on key aspects of university organization and teaching from the perspective of SFS. Universities are encouraged to embed systemic approaches into their research programming and organizational learning, with an emphasis on cross-disciplinary involvement that integrates social sciences, humanities, and industry perspectives. Capacity building is central to this effort, incorporating Responsible Research and Innovation (RRI), gender equality, FAIR data management, and territorial dimensions into educational frameworks. Stakeholder engagement plays a crucial role, with consultations designed to align annual programming and project evaluations. Networking and co-creation activities, such as those facilitated by FS-Labs, are essential throughout project stages and follow-up activities.

The establishment of a Food Systems Observatory aims to serve as a hub for sustainability metrics, data sharing, and policy alignment. This involves knowledge mapping to identify institutions and practices across the EU and Member States, and strategically designing user-oriented data systems supported by consortium agreements. The observatory's implementation follows a stepwise approach, starting with mapping food systems and outcomes, analyzing interactions to provide funding priorities, and offering decision support through forecasting tools. This will be key to embedding research and teaching in universities based on the latest data on SFS development.

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The creation of a Food Systems Knowledge Hub is another pivotal initiative. This hub focuses on the development of FS-Labs, which engage public and private stakeholders in co-creation activities and emphasize knowledge sharing and training. Community building is prioritized, involving intermediaries like agro-cooperatives, food industry federations, and technology platforms. Citizen participation is strongly encouraged to promote sustainable consumption behaviors. The Knowledge Hub also fosters global collaboration by aligning with international partners to enhance thematic knowledge sharing. Additionally, it integrates regional strategies and EU networks to capitalize on existing initiatives.

Knowledge sharing and scaling activities are central to the effort, with universities playing a key role in fostering learning networks, creating education programs, and building capacity. Initiatives include developing formal and informal education frameworks for schools, vocational training, and higher education to promote FS transformation. Universities also facilitate innovation scaling, policy coherence, and industry engagement through effective communication strategies that include clear visuals and targeted messaging. Strengthening the science-policy interface is a critical component, ensuring connections between academia and policy making at local, national, and global levels.

In summary, universities are positioned as central actors in transforming food systems. They achieve this through the integration of education and research, stakeholder collaboration, and global cooperation. The outlined activities underscore the importance of interdisciplinary approaches, thematic knowledge dissemination, and equipping students with the skills needed to address systemic challenges, fostering innovation and sustainable practices within food systems.

The charter draws on the above outlined directions and activities of the Partnership, thereby ensuring complementarity and synergy of activities between the SFS Partnership and the university community and related ecosystems (Fgure 6).

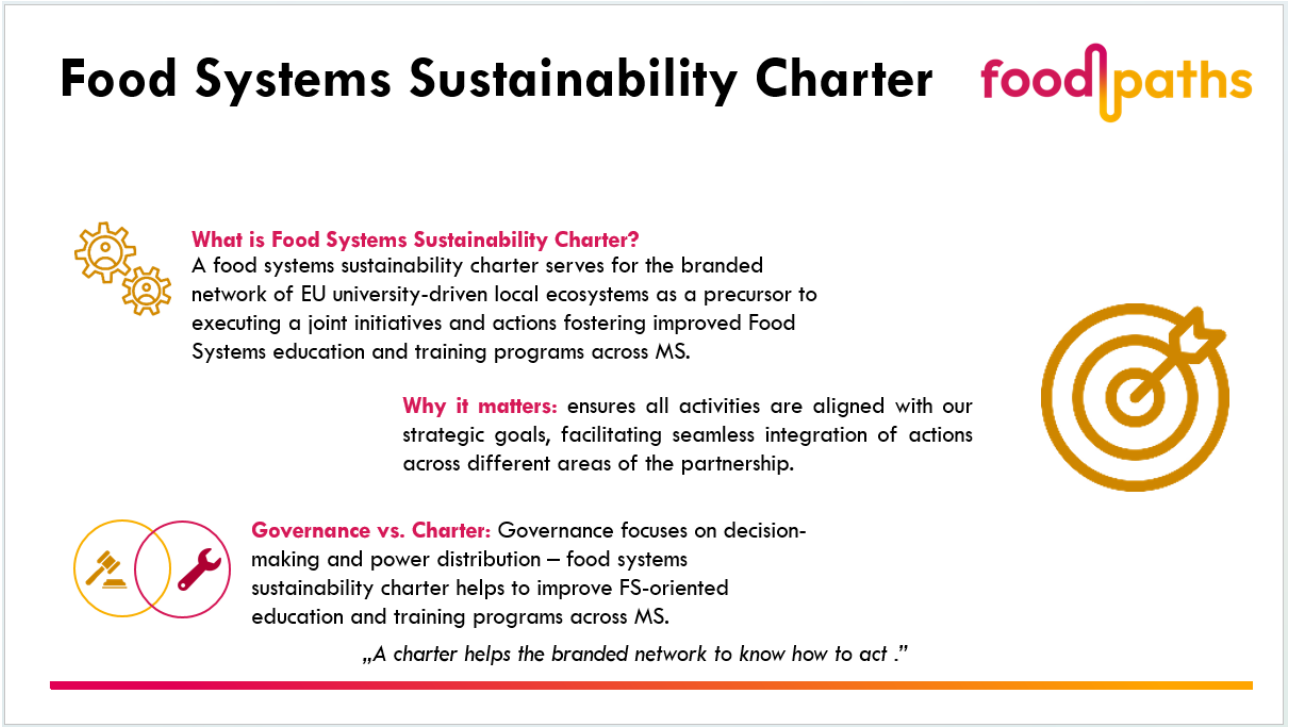

FIGURE 6 PRINCIPLES OF THE FS SUSTAINABILITY CHARTER (OWN STUDY)

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In this spirit, a sample charter has been prepared that corresponds to the statements that guide the Branded Network's activities, in line with the whole system approach presented within the governance model. Thus, we ensure the coherence of the approach and its maximisation of effects, resulting from simultaneous actions for food systems transformation, in the broad sense of the socio-economic system, where education determines the success of the process[38].

Taking into account the literature on the subject, the materials collected and those developed within the FOODPathS framework, an exemplary Charter would take the form of referring to the main elements of a systemic approach to the Partnership. Drawing on the experience of a network of universities, a network of food systems practitioners and experts, with an indication of the priorities of the approach to policy-making for food systems development (including Food2030) and research findings, the following content is suggested.

The Charter should conclude with a formula that represents a commitment to engage the university community in building a sustainable foundation for food systems transformation by working together to create the best learning activities, making improvements to the university's organisational system[39] and through activities with and for the community.

Food Systems sustainability charter

Vision and Mission

Vision:

To lead and inspire the transformation of food systems toward environmentally-friendly, socially secure and fair, economically viable, healthy and safe food systems in Europe through innovative research, education, and community engagement.

Mission:

To foster cutting-edge FS-oriented training, multidisciplinary research, and community engagement to accelerate the transition towards Sustainable Food Systems with a wide range of actors.

The charter adapts the vision and mission of the Partnership (SRIA, 2023) to a university-driven network with a primary focus on education, and secondary focus on research and on their ecosystem. To this end, the vision and mission statements point to shared principles by undersigned parties:
- Sustainability: all actions are taken to avoid that future generations are compromised in their actions
- Food Systems approaches: all activities are considered jointly from a food system perspective
- Inclusiveness: all actors are welcome to join, in a fair and balanced way
- Transparency: all communications are openly accessible

[38] Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D., Talsma, E. F., & Khoury, C. K. (2019). When food systems meet sustainability – Current narratives and implications for actions. World Development, 113, p. 124. and: Klerkx, L., & Begemann, S. (2020). Supporting food systems transformation: The what, why, who, where and how of mission-oriented agricultural innovation systems. Agricultural Systems, p. 184

[39] See: Leal Filho, W., Shiel, C., & do Paço, A. (2015). Integrative approaches to environmental sustainability at universities: An overview of challenges and priorities. Journal of Integrative Environmental Sciences, 12(1), 11.

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Strategic Objectives and Actions

1. Change the Way We Learn and Teach About Food Systems

- Integrate FS Concepts: Embed sustainable food systems education into university curricula, emphasizing planetary health, food security, and resilience.
- Develop FS Labs: Establish experiential learning hubs (Living Labs) to train students in systemic innovation for FS transformation.
- Promote Lifelong Learning: Provide capacity-building programs for professionals and communities, including marginalized groups.

Action Example:
Develop a framework for FS educational programs that integrate local cultural and ecological contexts, using place-based and co-creation methodology

2. Change the Way We Connect Education to Research on Food Systems

- Prioritize Systems Thinking: Advance research on the interplay of FS elements, addressing trade-offs and synergies across environmental, social, and economic dimensions.
- Support Transformative Innovations: Focus on new protein sources, circular food systems, and climate-smart agricultural practices.
- Create Knowledge Sharing Platforms: Facilitate the dissemination of best practices through FS knowledge platforms and observatories.

Action Example:
Launch multidisciplinary research initiatives targeting FS challenges such as reducing greenhouse gas emissions or advancing food justice at the regional level (network).

3. Change the Way We Teach and Experiment about Govern Food Systems Transformation

- Enhance Stakeholder Engagement in training sessions: Foster collaborations with policymakers, NGOs, and industry to co-design solutions.
- Strengthen the links between R&I, Policy and Education (RIPE) pillars, with particular reference to education: Provide evidence-based policy recommendations and governance models that reflect local FS complexities.
- Promote Equity in Access to Knowledge: Address food systems knowledge inequities by ensuring fair access to resources and innovations to all.

Action Example:
Organize annual FS RIPE forums where researchers, students, and local governments discuss actionable recommendations for sustainable food systems governance.

4. Change the Way We Involve Communities within University-driven Food Systems

- Citizen Empowerment: Engage communities through public campaigns, participatory workshops, and citizen science initiatives.
- Support Local Food Networks: Strengthen regional food systems by linking local producers, processors, and consumers, give them feasibility at the campus.
- Raise Awareness: Promote sustainable diets and food literacy through targeted outreach and education programs.

Action Example:
Implement community-driven food initiatives to enhance public understanding of sustainable diets and the environmental impacts of food choices. Become an active part of our local, regional, national and global community.

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Commitment to Food Systems Transformation

This charter calls on universities, research centers, and education programs to act as leaders in fostering sustainable FS transformation.

By working collaboratively and committing to the principles outlined here, these institutions will not only transform local and regional food systems but also set global standards for excellence and innovation

BOX 1 - SAMPLE FOOD SYSTEMS SUSTAINABILITY CHARTER (OWN STUDY)

The proposal for a Food Systems Sustainability Charter, which dovetails with the Partnership's overarching SRIA document, is one important element of governance, the basis for the collaboration of universities, the organisation of their activities and teaching, taking into account the needs and inclusively supporting the creation of local ecosystems of innovation in food systems transformation[40].

6. Code of conduct

A Code of Conduct is a set of rules outlining the social norms and rules and responsibilities of or proper practices for an organization[41]. They ensure compliance with laws and regulations that form a basis for the network. Codes of conduct can serve as a guide to help organizations address specific legal and ethical issues they may be confronted with, and they are often enforced at all organizational levels. In the case of the Partnership, the Code of Conduct will be developed in the final phase of its workplan; this prepares the governance and its synergistic elements.

Desk research shows that several Codes of Conduct, on university level, national level, and program level, for HERI already exist. For instance 67 universities in the Netherlands have signed the Code of Conduct for International Students in Higher Education[42]. This Code is a document containing rules of conduct intended to guarantee and improve the quality of education for international students in higher education. With the rules and standards laid down in the Code, the affiliated institutions guarantee a certain uniformity in the quality of the information provided to and care for international students. Additionally, each university normally also applies a Code of Conduct for students, for staff, for academic integrity, for digitalization. No Codes of Conduct that addresses sustainability has been found. This requires urgent attention.

Desk research also shows that multiple projects and organizations (for instance the EC Report on the final outcomes of the Erasmus+ policy experimentation projects: European degree (label) and institutionalised EU cooperation instruments; Bologna Tirana Commique; New Skills agenda EC) seek for ways to structure the European Commission's aim to enable European higher education institutions to cooperate closer and deeper, to facilitate the implementation of joint transnational educational programmes and activities, pooling capacity and resources, or awarding joint degrees[43].

[40] Cf. Neufeld, L., Hendriks, S., Hugas, M., & Devlin, T. (2022). Achieving food system transformation: Insights from a decade of research in Europe's Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI). Food Security, 14(6).
[41] Stuijvenberg, M., & van der Wende, M. (2005). Code of Conduct with respect to international students in Dutch Higher Education: Guaranteeing quality? European Journal of Education, Vol 40(1), 31–49
[42] https://www.internationalstudy.nl/wp-content/uploads/2023/12/Code-of-Conduct-HE-2024.pdf
[43] Manni, U., & Ott, A. (2020). University governance and sustainability: The transformation potential of codes of conduct. Sustainability, 12(23), 10128

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While there are many initiatives that emphasize the importance of sustainability, innovation, and collaboration in higher education, they do not provide a detailed charter or Code of Conduct specifically covering the four key areas (curriculum development, campus operations, community engagement, research and innovation partnerships) identified as part of the systemic solutions enabling HERIs to act as catalysts for SFS transformations. No specific mention of a charter or Code of Conduct that addresses these key areas has been identified.

For instance, the Tirana Communiqué highlights the need for higher education institutions to address societal challenges, including sustainability and digitalization, and encourages the development of inclusive and innovative educational practices[44].

Similarly, the European Commission's initiatives within the EHEA aim to strengthen ties in higher education, focusing on interconnectedness, inclusivity, and competitiveness, but do not detail specific guidelines for curriculum development, campus operations, community engagement, or research partnerships related to food systems[45].

While the overarching themes align with the 4 key areas identified, a specific charter or Code of Conduct encompassing all does not appear to be present.

While there isn't a universal European charter or Code of Conduct that explicitly addresses all the four key areas, several European universities and organizations have developed frameworks and initiatives focusing on sustainability in higher education. There is one interesting concept, the **Green Office Model[46]**: Originating in Europe, the Green Office Model establishes sustainability offices within universities, often led by students, to promote sustainable practices across campus operations, curriculum, and community engagement. These offices work to integrate sustainability into university life, addressing areas like waste management, sustainable procurement, and fostering partnerships with local stakeholders. This has led to projects and advice on how to integrate sustainability, yet again not supported by a Code of Conduct. Additionally, our reviews confirmed that university administration sees the potential and need for introduction of a 'chief sustainability officer' in the organisational structure of the HERI[47], supporting (governing) the process of implementing the principles of a systemic approach and organising the campus according to the developed SFS principles. This is a recommendation to be discusses within the collaborative network of leading SFS universities/HERI.

Green Deal roadmap towards a Code of Conduct

What comes closest to a Sustainability Code of Conduct, is the European University Association (EUA)'s "A Green Deal roadmap for universities", which provides policy frameworks to integrate sustainability into scientific, educational, and institutional activities. These documents offer guidance on embedding sustainable practices in various university operations, including curriculum development and research partnerships[48].

[44] Values, inclusion, mobility - Bologna Process enters new working cycle at Tirana Ministerial Conference
[45] https://education.ec.europa.eu/fr/news/commission-forges-stronger-ties-in-the-european-higher-education-area?utm
[46] The Green office model: making universities more sustainable, ED/PSD/ESD/2016/PI/7, https://unesdoc.unesco.org/ark:/48223/pf0000245763
[47] Cf. Findler, F., Schönherr, N., Lozano, R., Reider, D., & Martinuzzi, A. (2019). The impacts of higher education institutions on sustainable development: A review and conceptualization. International Journal of Sustainability in Higher Education, 20(1), 23–38.
[48] https://www.eua.eu/publications/reports/a-green-deal-roadmap-for-universities.html?utm

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This comprehensive framework guides higher education institutions toward sustainability and climate neutrality.

The roadmap emphasizes four key areas:

1. Research and Innovation:
    - Interdisciplinarity: Encourages collaborative research across disciplines to address complex environmental challenges.
    - Flexibility: Advocates for adaptable research agendas that can respond to emerging societal needs.
    - Implementation Science: Promotes the application of research findings to develop practical solutions for sustainability.
2. Education and Students:
    - Curriculum Integration: Supports embedding sustainability concepts into all educational programs.
    - Active Engagement: Encourages student participation in sustainability initiatives both within and beyond the campus.
    - International Cooperation: Promotes the development of joint programs with institutions in countries heavily impacted by climate change.
3. Staff and Operations:
    - Sustainable Practices: Advocates for the adoption of environmentally friendly campus operations, including waste management and sustainable procurement.
    - Institutional Growth: Encourages universities to consider the environmental impact of campus expansion and to explore alternative growth models.
    - Enhanced Value Principle: Supports the shift from cost-based to value-based procurement, considering social and environmental criteria.
4. Public Engagement and Societal Impact:
    - Community Partnerships: Encourages building strong relationships with local communities to address environmental challenges collaboratively.
    - Knowledge Sharing: Promotes the dissemination of research findings to the public to raise awareness and drive societal change.
    - Policy Advocacy: Supports active involvement in policy discussions to influence environmental legislation and practices.

The roadmap also identifies catalysts that cut across these areas, such as interdisciplinarity, collaboration, and a commitment to equality, diversity, inclusion, and belonging (EDIB). It serves as an inspiration and template for how universities can face the climate and environmental challenges over an extensive timeframe, enabling them to make both an effective contribution and serve as exemplars of sustainable communities.

Ultimately, the roadmap should serve as an inspiration and template for how universities can face the climate and environmental challenge over an extensive timeframe, enabling them to make both an effective contribution and serve as exemplars of sustainable communities. In view of the different actions and processes required to meet the challenge of the Green Deal, this roadmap defines a horizon of possibilities for the university sector. The latter must not just be a part but an exponent of the societal transition to sustainability. EUA is committed to ensuring wide dissemination and uptake of the roadmap, as well as to

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facilitating systematic dialogue regarding the sector's needs and expectations in working towards the objectives outlined above. Through specific activities aimed at, and co-created with, universities and their partners as well as decision makers and other stakeholders, the Association will pursue a comprehensive enhancement of universities' role across the many areas of the green transition in the coming years. This process will be closely monitored with a view to updating the roadmap at regular intervals.

7. Conclusion

In the study we argue that an innovative and collaborative curricula and portfolio of innovative courses focused on SFS should be developed to support universities in driving transformation. These efforts include interdisciplinary modules addressing food systems' economic, social, and environmental impacts across all education levels, from undergraduate to doctoral programs. To complement traditional education, micro-credentials can help bridge knowledge gaps within the industry.

It should be stressed that iInter-university collaboration is vital for creating comprehensive curricula, supplemented by competitions to encourage creativity and interdisciplinary thinking. Project-based learning can strengthen ties between academia and industry, while sustainability considerations should be integrated into lab work and courses. Workshops on sustainable lab practices and the formation of a dedicated task force can further promote the incorporation of food systems and sustainability concepts into academic programs. Policymakers play a critical role in enabling these initiatives. They should improve accreditation systems to allow universities to adapt rapidly to sustainability and industry needs, including fast-tracking new curricula. Standardized guidelines for mandatory sustainability metric reporting in industries would enhance accountability and transparency, while public awareness campaigns can foster societal support for sustainable practices.

The collaboration between academia and industry should be reinforced through mechanisms like project-based learning and initiatives such as the reverse incubator methodology, which facilitate knowledge exchange and foster stakeholder partnerships. Embedding SFS into higher education requires a systems-oriented approach, encompassing curricula, campus operations, and community engagement. Universities can serve as models for sustainability by integrating these principles into procurement, catering, waste management, infrastructure, and experiential learning through living labs or collaborations with local ecosystems involving academia, industry, community, and policymakers.

The desk study, followed by workshop discussion sessions, confirmed, that rather than creating a new university network, it is essential to optimize existing examples of successful collaborative models. Programs like EIT Food's Master in Food Systems and IFSTAL showcase interdisciplinary, cross-border education models that align well with sustainability and innovation goals, whereas networks such as ELLS (Euroleague for Life Sciences) and initiatives like EduXchange and European bioeconomy university, highlight how inter-university collaboration can address specific educational and societal challenges, including sustainability. Flexibility through Course Portfolios offers a less administratively burden and an alternative to joint degrees, allowing for more agile and responsive collaboration. Examples like EduXchange and alliances such as EWUU demonstrate how shared courses across institutions can foster interdisciplinary learning and societal impact. At the same time, the growing emphasis on lifelong learning and microcredentials is aligned with the need for flexible and adaptive education models, allowing institutions to meet evolving workforce and societal needs. Projects like Cleverfood, FoSSNett, and FOODPathS share complementary approaches but may have different objectives. Coordinating these efforts under a unified strategy requires ongoing dialogue among

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stakeholders, supported by the European Commission. Future partnerships could play a catalytic role in aligning these networks with shared goals. Close ties with Bologna process and EHEA should be maintained in this process. This will make it possible to influence more flexible accreditation rules and the creation of curricula that are more responsive to community and industry needs (as they reflect job market needs).

Careful planning is required to define a branded network's criteria and establish compliance requirements for institutions seeking to join. Inclusivity must be prioritized by developing training concepts that support HERIs that may not yet meet these criteria but are eager to participate. This can be included in the Code of Conduct.

As a conceptual approach, the Branded Network can act as Catalysts for Collaboration, where the concept of a branded network provides a framework for universities to collaborate transnationally, either as the core of an ecosystem or as entities that form an ecosystem. Central binding factors such as a Code of Conduct and a Sustainability Charter are identified as critical. Still, they are currently absent within the EU HERI framework. Regarding the integration of Internationalization and Quality Assurance, the trend of internationalization in curricula, teaching, and learning has become increasingly relevant, with universities and quality assurance agencies seeking to embed it systematically, while methodologies to assess internationalization are in demand, a consistent framework is lacking. Existing Supportive European Frameworks, with initiatives like the European Degree and joint programs/joint degrees aim to simplify and enhance collaboration between universities, but significant administrative and structural hurdles persist. The Bologna Process and its outcomes, such as automatic qualification recognition and microcredential recognition, provide a pathway for collaboration but require further structural changes and alignment across member states.

This approach underscores the importance of fostering collaboration, sustainability, and inclusivity to create impactful branded networks that can drive higher education forward.

Achieving a SFS transformation in the EU requires a coordinated, multi-stakeholder approach, integrating research, education, industry, and policy efforts. Universities, as central hubs for knowledge creation and innovation, have a critical role in this process, both in educating future leaders and catalyzing systemic change through research and collaboration. The development of a branded network for institutions of higher education and research, guided by a shared charter and code of conduct, can serve as a vital tool for advancing sustainability in food systems across Europe[49].

The research indicates that a sustainability charter has the potential to become the basis for university collaboration activities, forming the backbone of an approach whereby universities develop a common approach to a/ campus management, education in practice in relation to the practical aspects of the food system as it operates in the campus (e.g. food waste or diet), but also as a guiding support for the 'branded network' approach to curriculum planning (curricula). The approach presented in this report is only an example that builds on the experience of others who already have such a charter, the principals identified by experienced experts in shaping food systems transformation and, finally, building on the FOODPathS approach developed within FOODPathS, from the collaboration with the SCAR FS SWG. We believe that it contains the main priorities and will support the activities of actors, who can build on it (and the data in this report) to create a practical code of conduct (which turns out to be a very individual matter, to be worked out by an already existing body), and on their basis an action plan for further activities. In order to do so,

[49] Cf: Donner, M., Mamès, M. & de Vries, H. Towards sustainable food systems: a review of governance models and an innovative conceptual framework. Discov Sustain 5, 414 (2024). https://doi.org/10.1007/s43621-024-00648-x

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consideration should be given to preparing a new call for proposals within the framework of the Partnership, which would help to attract and bring together the best academic units that are already operating within the food systems philosophy, to give them the time and resources to develop guidelines for improving the education system according to generally accepted guidelines, created at university level, with the participation of the industry and in consultation with accreditation bodies (including, above all, the Bologna process).

As this initiative progresses, universities should be encouraged to adopt integrated sustainability practices both in their educational programs and campus operations, ensuring that they lead by example. Collaboration across networks such as EIT Food, Cleverfood, Fossnet, and FOODPathS, alongside the European Commission, will be key in aligning objectives and strategies, ensuring that diverse networks contribute towards a unified vision for SFS. Together, these efforts will foster the transformation needed to build a resilient, sustainable food future for people, planet, and climate.

8. Recommendations and actions

Concrete recommendations are:

- further research possibility of portfolio of courses and joint degree with support of ECA for accreditation
- further research on administrative and legislative barriers while promoting inclusivity for diverse institutions.
- A **Code of Conduct** and **Sustainability Charter** should be prioritized to ensure shared values and goals across participating universities.
- Collaborative frameworks like the **European Degree** and flexible course portfolios provide scalable solutions for enhancing educational mobility and innovation.
- Successful examples, such as the **EIT Food Master** and **ELLS**, offer replicable models that other institutions can adapt to their unique contexts.
- A clear focus on **lifelong learning**, **microcredentials**, and transdisciplinary collaboration will ensure that branded networks remain future-focused and aligned with global challenges.

To implement above, we recommend the Partnership to prepare a competition (call) for the preparation of a cooperation (within the branded network concept) of the universities we identify as leaders of change (15 universities identified in the mapping activity), but not limited to this ones. The activities of the Partnership funded project would allow universities to work with industry partners, with student participation, to develop principles for the creation of a model curriculum (or guidelines) that would be in line with the concept of SFS and thus allow universities to collaborate freely in educational activities, principles for running campuses in the local ecosystem, collaborating with the environment and creating a field of dialogue with the institutions of the accreditation system.

These activities would allow for the development of a bottom-up (university-led) approach to the dissemination of uniform principles:

- the creation of study programmes, in line with the SFS concept, allowing the pooling of capacities and infrastructures of universities from different European countries,

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- the possibility to create a "fast track" accreditation in response to business needs and more possibilities to change existing ones between the usual accreditation periods,

- would allow for the gradual inclusion of other universities in the network of implementing bodies, through the adoption of a common Food Systems Sustainability Charter and Code of Conduct, which would be developed by the leading bodies in this field,

- would prepare guidelines and organisational solutions for a better organisation of campuses, scientific life, cooperation with the local community, promotional and educational activities of the Food Systems Sustainability Principles around university life,

- maintain a dialogue with the European Commission and respective bodies towards the synchronisation of educational, demonstration and strategic actions for the broad transformation of food systems in Europe and support with data and experience the evidence-based policy-making process.

Action	Who	When	Resources
Call on collaboration of the branded network	Partnership governence	second half of 2025 or first half of 2026	Budget of the partnersip

TABLE 3 - PROPOSED ACTION

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ANNEX I Survey

The survey was intended to support the development of a sample charter for higher education and research institutions, which points to a core elements (FS principles) and exemplifies the role such organisations can play in catalysing sustainability in food systems as a drivers for change of local echosystems. However, the establishment of a separate organisation, a network based on universities, is superfluous when dealing with well-organised, existing networks. Therefore, the intention was to investigate and learn universities how (by curricula, organisation system, contacts with the local environment) that they can motivate staff, students, partners and citizens to foster FS transformations. These are important for local/regional communities and reveal the diversity of Member States' solutions. This is also an imperative for consistency in EU Research, Innovation, Policy Advice and Education programmes.

The questionnaire was structured to define how universities understand the definition of SFS and how they implement the principles of this approach in the preparation and implementation of curricula, in the organisation of the university and its campuses, but also when interacting with the local and regional ecosystem of which they are a part (i.e. local politicians, the public, other institutions).

The questionnaire was disseminated by the project partners' networks and also discussed (as a pooling material with life sciences university networks. The results are based on the complete indications of the 12 organisations. The questionnaire is available online, and presented in the annex.

The results of the survey indicate some general findings, giving a picture that is necessary for a good organisation of cooperation and networking of universities.

The survey responses reveal diverse perspectives on SFS across universities. When asked whether a common approach or understanding of SFS exists within their institutions, responses ranged from full agreement to partial acknowledgment, with some highlighting ongoing efforts to improve interdisciplinary collaboration. Systemic thinking approaches and sustainability charters were noted as implemented by some universities, with examples including specific research groups and structured roadmaps for ecological responsibility. However, partial implementation or a lack of emphasis on such frameworks was also noted by some respondents.

The definition of SFS is known but not always well-placed in universities curricula (it is present in agricultural economics and food processing'). Universities have been increasingly developing food systems-related courses and majors, though the need for effective learning opportunities to prepare students for leadership roles in this domain is still growing.

The findings suggest that a SFS approach is already present in bachelor and master studies, but less in lifelong learning programs. This SFS approach emphasizes the interconnectedness of various disciplines involved in food production, processing, and consumption, spanning from agriculture to nutrition, and highlights the multifaceted dimensions of sustainability in these domains.

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Surveyed universities stress that a systemic approach requires cooperation and continuous communication with business, policymakers, and civil society to successfully implement the SFS approach.

Corporate practises and organisation of Universities include food systems approach in campus organisation, but these actions are not systemic, they usually are fragmented and lacking coordination (governance support). Only the larger universities are implementing a more complex programme, in other cases these activities (if carried out) are limited to selected elements that make up the systems approach, eg. a food waste management system, sustainable food options available in the cafeteria... Also, only some of them indicate that they have corporate social responsibility programs, follow a specific standard or label (e.g., ISO 26000) or have action plan aimed at achieving the SDGs. At the same time, it is important to point out the need for systematic education and awareness-raising of the entire university community in this regard.

In terms of the impact of universities on the local ecosystem, they interact with policymakers at their local and regional level - only some in terms of SFS, others are looking for opportunities and tools to promote the SFS approach. A popular form of community outreach is the organisation of workshops and conferences on SFS, but also the promotion of knowledge and good practices in the media and in local initiatives (such as science festivals).

Many universities reported active engagement, with examples of providing policy briefs, consultations, and participating in regional or national initiatives. Similarly, several universities identified good practices related to SFS curricula, including Master's programs and co-creation opportunities that integrate public and private stakeholders. However, a few institutions expressed uncertainty about their ability to share or identify such practices.

Membership in national or international bodies dealing with SFS varied, with some universities actively participating in networks and leveraging these connections for broader collaborations. Others either did not engage in such memberships or were unsure of their involvement. Knowledge requirements for graduates at different levels were diverse, reflecting the institutional focus. For undergraduates, some universities emphasized foundational knowledge in natural sciences, while for graduate and postgraduate levels, deeper specialization and decision-making skills related to food processing, sustainability, and consumer behavior were highlighted. Notably, some institutions reported no explicit degree programs or formal requirements tailored to SFS.

Finally, interest in joining an EU-branded network to foster improved FS education and training programs elicited mixed responses. Some universities expressed clear interest and a willingness to participate, while others were uncertain about their capacity or readiness to engage. These responses collectively underscore the varied levels of engagement, institutional priorities, and challenges faced by universities in advancing SFS.

Systemic approach related to food systems transformation represented at the University level based on:

- Principles, rules, legislation to support internal organisation and corporate practises
- Academic curricula and training programmes encompassing SFS concepts
- Community engagement through participatory approaches for transformative learning

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This calls for new approaches in the accreditation system: „fast track" to better respond to the job market and industry needs. Fostering multi-actor cooperation on curricula and accreditation (business-science-policy) is key to effectively integrate the food systems concepts into higher education in a sustainable way. What's more, correct communication channels should be developed to ensure proper identification of needs from businesses for food systems science and their proper understanding of SFS transformation: innovations, trends, EU/national policy that influences economic transformation.

Branded network of research in this context, should enable a multifaceted collaboration between universities and a group of local/regional actors (such as industry, community organisations, citizens, policy-makers, etc.) to work together on a systemic approach to food systems change, through testing, sharing best practises, explaining SFS approach to stimulate the idea of University-driven local ecosystems in Europe and beyond.

While universities are aware of the need to transform food systems, they are making efforts to implement the basics of this approach in educational programmes and organisations, there remains significant scope for realizing the transformative potential of higher education to address the complex approach of the SFS concept.

The results of this exercise were one element of a holistic approach to discussing the principles of establishing a branded network, pointing to the main directions of the food systems sustainabilitysustainabilty charter, as well as the code of conduct.

ANNEX II Debate educational needs

Special Session Stakeholder debate on educational needs toward food systems transition

EFFoST2024 Conference, Bruges, Belgium. November 12, 2024

The meeting focused on transforming education to support SFS, involving stakeholders like academia, industry, and student representatives. The expected outcomes were to learn what is needed at the University level to design modern, innovative, SFS-oriented curricula that are attractive to students and industry. From the Food industry, we wanted to learn what their experience of working in ecosystems or parcs or other networks? and if they see a role of the industry in supporting the HERI? Which barriers do they see? How should students be prepared for the workforce compared to now? From the students, we specifically hoped to understand how they imagined their perfect course in food science and how they would describe the innovation in a course of study.

Outcomes of the debate

Universities should be supported in developing innovative and collaborative curricula focused on SFS. This includes integrating sustainability topics at all education levels, from undergraduate to PhD and postdoctoral programs, and introducing interdisciplinary modules that address the economic, social, and environmental impacts of food systems. To complement traditional education and address industry knowledge gaps, micro-credentials can be developed. Inter-university collaboration should be

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encouraged to create comprehensive curricula, alongside initiatives such as competitions to foster creativity and interdisciplinary thinking. Project-based learning should be implemented to bridge the gap between academia and industry, while discussions on environmental impact and sustainability should be incorporated into lab work and courses. Workshops on sustainable lab practices and alternatives can further raise awareness, and a dedicated task force can be established to drive the integration of food systems and lab transformation topics into academic programs.

For this, support from policymakers is needed; they play a key role in advancing sustainability by improving accreditation systems to help universities adapt quickly to business and sustainability needs, including fast-tracking new curricula. They should also establish clear, standardized guidelines to make industry sustainability metric reporting mandatory. Additionally, policymakers should promote public awareness and engagement by effectively communicating the importance of sustainability, fostering broader societal support for sustainable practices.

The industry should adopt mandatory sustainability metric reporting through standardized guidelines to ensure accountability and transparency. Collaboration with academia can be strengthened by encouraging project-based learning in universities, helping bridge the gap between academic knowledge and industry needs. Additionally, research and innovation initiatives, such as sharing the reverse incubator[50] methodology, can facilitate knowledge transfer and foster collaboration between stakeholders.

Topics discussed

1. **Food Systems Transformation, University Collaboration, Accreditation System, Sustainable Food Systems**
   The meeting focused on universities' roles in food systems transformation, highlighting organization, teaching, and communication. A branded network was proposed for collaboration among leading universities to create a European framework for change. The need for an accreditation system balancing university independence and business needs was discussed, with a call for organized dialogue between universities and businesses. Stakeholders from universities, industry, and students participated, sharing thoughts via a QR code.
2. **Collaborative Education, University Support, Innovative Curricula, Sustainable Food Systems**
   The discussion centers on supporting universities to be more collaborative, involving RIPE—research, innovation, policy, and education—and designing modern, sustainable food system curricula responsive to economic and societal changes.
3. **Accreditation Processes, Sustainability in Education, Micro-Credentials, Industry Collaboration**
   The meeting emphasized fast-track accreditation in universities like the University of Zagreb to

[50] The Reversed Incubator (RI) training initiative intends to design and develop new business opportunities (e.g. start-up, enterprise, company, …) starting from the needs/opportunities of innovation expressed by existing companies or enterprises. These innovation needs (or "challenges") are then developed into ideas by talents under the supervision of mentors within a business-oriented training (using the "FORTH methodology") and co-creation project development framework. The Reversed Incubator promotes the creation of new business ideas by combining different players and, in particular, existing companies, universities, research centres and training experts, each of them with specific roles and activities to develop. Talents (e.g. bachelor and master students, PhDs, ...) under the supervision of mentors (or experts, e.g. teachers, researchers, trainers, professionals, etc.) interact with the company owners (or entrepreneurs) to implement the fixed challenge and develop the innovative solution and business idea. Overall this methodological approach is aimed to improve the entrepreneurial and professional-oriented skills of the talents by practicing them during project development while companies can benefit from the inspiring environment to promote their innovation. The RI has been designed and piloted within the Erasmus+ KA2 ASKFOOD and currently embedded in teh Master degree in Food Science and TEchnology of UNITE.

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meet job market needs, focusing on food systems. Sustainability, aligned with SDG number four, was stressed through interdisciplinary modules and tools like life cycle assessments. Core areas like food safety and food engineering were highlighted. Micro-credentials were crucial for complementing education and bridging industry gaps. Successful collaborations in Denmark and Italy were noted, with European Union support deemed essential. The role of economic students in developing business models for sustainability was also emphasized.

4. **Engineering Education, Industry Collaboration, Sustainability in Academia, Environmental Impact of Research**
   Poznan's engineering education faces challenges with a focus on basic engineering, economy, and technology. Many students skip master's theses, limiting exposure to advanced technology and sustainability affecting industry readiness. Academia and industry differ, and lack of student involvement in industry projects exacerbates this. Sustainability is inadequately integrated, especially at PhD and postdoc levels, hindering university progress. Environmental impacts of lab work, like plastics and chemicals, are overlooked, affecting the environment and society. A middle ground between academia and industry is needed, emphasizing food systems and lab transformations, with a call for curriculum changes to better prepare students for industry roles, addressing sustainability and environmental impacts.
5. **Interdisciplinary Education, Sustainability Challenges, Soft Skills Development, Curriculum Innovation**
   The discussion focuses on integrating soft skills and interdisciplinary approaches in university curricula, emphasizing creative thinking and collaboration across study programs like farming and economy. Participants propose optional courses on communication and interdisciplinary work, with industry role models demonstrating practical applications. Challenges of accreditation and benefits of understanding complex systems, including legal and societal aspects, are discussed. The urgency of addressing sustainability and climate change is highlighted, with a call for parallel efforts to build new curricula. The speaker mentions food safety and quality engineering, local ecosystems, physicists' role, biodiversity's importance, societal challenges, and the need for psychological adaptation in shaping educational content.
6. **Sustainability in Education, Industry-Academia Collaboration, Digitalization in Food Processing, Sustainable Practices in Industry**
   The meeting emphasized sustainable lab practices, focusing on raw materials and chemicals, and integrating living and green labs into curricula. A problem-based approach with student, academia, and industry collaboration was advocated. The Erasmus project on green skills, digitalization, and upcycling was completed. Differentiating actual from claimed sustainability in food systems was stressed, focusing on reducing energy consumption and CO2 footprint through efficient processing. Digitalization and optimization in industrial processes were discussed, highlighting integration across sectors. Obligatory sustainability reporting and governmental support were deemed essential. The challenge of balancing comprehensive sustainable education across universities was addressed, alongside the need for industry to perceive sustainability as beneficial rather than a constraint. The importance of stakeholder value over shareholder value was also highlighted.

Potential actions

Curricula/universities;

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- Develop a plan to support universities in creating collaborative, innovative curricula focused on SFS.
- Revise university curriculum to integrate sustainability topics more thoroughly at all levels, including PhD and postdoc programs.
- Implement interdisciplinary modules in food systems curricula to address sustainability impacts on economy, society, and environment.
- Explore the development of micro-credentials to complement traditional education and address industry knowledge gaps.
- Create a task force to explore ways to integrate food systems and lab transformation topics into the curriculum.
- Explore collaborations or competitions to enhance creativity and interdisciplinary thinking in university programs.
- Explore collaboration opportunities between universities to create a comprehensive SFS curriculum.
- Encourage project-based learning in universities to bridge the gap between academia and industry.
- Incorporate discussions on environmental impact and sustainability in lab work and method development in university courses.
- Organize workshops for students on the environmental impact of lab practices and sustainable alternatives.
- Discuss integrating sustainable practices in lab curricula with academia and industry stakeholders.

Accreditation:

- Explore improvements to the accreditation system to help universities respond more quickly to business needs. Develop a fast-track accreditation process for curricula and modules to align with industry needs and sustainability goals.

Link to professional life:

- Develop a program to increase student involvement in industry projects to bridge the gap between academia and industry skills.
- Introduce optional courses focused on soft skills and interdisciplinary communication in university curricula.

Industry:

- Develop guidelines for the industry to report sustainability metrics, making it obligatory rather than optional.
- Encourage project-based learning in universities to bridge the gap between academia and industry.

Policymakers:

- Develop guidelines for industry to report sustainability metrics, making it obligatory rather than optional.
- Investigate ways to communicate the importance of sustainability to the general public effectively.

Research and innovation:

- Share the reverse incubator methodology and results with interested parties to promote knowledge transfer and collaboration.

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ANNEX III FOODPathS closed workshop: potential and challenges in scaling up modern food technologies

EFFoST2024 Conference, Bruges, Belgium, November 13, 2024

Through collaboration with Good Food Institute, EFFoST invited 12 high-level expert speakers from various organizations, to reflect on the potential and challenges in scaling up modern food technologies. The session focused on the following 3 questions:

4. Which R&D and scaling challenges must modern food technologies like Precision Fermentation and Cellular Agriculture overcome to hit key disruption points?
5. What bottlenecks prevent the academic and commercial research ecosystem from addressing these challenges - funding, knowledge, and collaboration access? How can we address this?
6. How can other actors (such as policymakers, investors, businesses, and civil society) contribute to accelerating the adoption of precision fermentation and cellular agriculture?

The main conclusion was that the success of modern food technologies like Precision Fermentation and Cellular Agriculture depends on solving technological, regulatory, and societal challenges through a collaborative and sustainable approach. By addressing talent shortages, funding gaps, and regulatory inefficiencies, these transformative technologies can move closer to becoming mainstream, helping to meet global food demands in a scalable, affordable, and environmentally sustainable way.

1. R&D and Scaling Challenges

- **Scalability and Cost:** CM and PF technologies must transition from small-scale research to industrial production, addressing the massive infrastructure requirements for bioreactors, engineered cells, and affordable inputs like feedstocks (e.g., glucose). Developing minimal formulations for cell media and finding alternatives to stainless steel for bioreactors are critical to reducing costs and resource dependencies. Achieving metric tons of output for CM (not just kilograms) will demand substantial innovation and investment.
- **Sustainability:** Sustainability assessments, particularly for energy and sidestream usage, need to be prioritized earlier in the R&D process. Developing circular processes is both a challenge and an opportunity, as waste streams (e.g., GMO yeast sidestreams) could potentially be reused for animal feed or other applications.
- **Technical Gaps:** Foundational knowledge on protein structure, function, and interactions remains limited, necessitating large-scale screening and genomics/metabolomics research. For PF, balancing high-value niche products (e.g., lactoferrin) with affordable bulk proteins is critical for both commercial viability and global food security.
- **Talent Shortages:** There is a lack of skilled professionals in bioreactor operations, chemical engineering, and fermentation science. Addressing this requires targeted educational programs and recruitment of diverse stakeholders, including chefs, farmers, and engineers.

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2. Bottlenecks in the Ecosystem

- **Funding:** Both PF and CM technologies suffer from limited funding, particularly for scaling. The risk-averse private funding landscape prioritizes trending sectors like AI. Public-private

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partnerships, taxpayer investment in pre-competitive research, and funding models like Denmark's Novo Nordisk Foundation could help derisk these technologies and stimulate innovation.

- **Collaboration and IP Issues:** Collaboration between academia and industry is hindered by intellectual property (IP) concerns, as companies often prioritize proprietary strains and trade secrets. Centralized, open-access resources (e.g., shared cell lines, genomics data) could bridge these gaps and enable faster progress. Countries like the Netherlands and Germany provide strong examples of effective collaboration through models like Fraunhofer Institutes and public-private partnerships.
- **Regulation:** Regulatory frameworks, particularly in Europe, are fragmented and slow, compared to regions like Singapore or Israel. Approval processes for novel foods require producers to supply sufficient data, but production at the needed scale is often a bottleneck. Policymakers must streamline regulations and foster dialogue between regulators (e.g., EFSA) and companies to expedite approvals.

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3. Market and Societal Considerations

- **Market Adoption:** Achieving price and taste parity with conventional products is essential. Subsidies for the meat industry create an uneven playing field, making it harder for alternative proteins to compete. Additionally, public discourse should emphasize diversification rather than "disruption" to reduce resistance from traditional industries and policymakers.
- **Global Relevance:** Solutions must work in both the Global North and South, addressing diverse needs and resource availability. A mixed approach combining PF, CM, and other alternative protein technologies is necessary to meet the massive global demand.
- **Vertical Integration Risks:** Many investors prioritize vertical integration, but this approach can stifle collaboration and broader sectoral growth. Instead, large-scale industry involvement and partnerships with SMEs should be encouraged.

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4. Opportunities and Recommendations

- **Sustainability:** Building circular and sustainable processes, integrating sidestream applications, and minimizing energy inputs are critical for long-term success.
- **Skills Development:** Tertiary education programs and professional training should target the skills gap in fermentation, bioprocessing, and engineering. Chefs and farmers should also be engaged to foster acceptance and practical application of these technologies.
- **Public-Private Collaboration:** Governments should establish public-private partnerships to fund pre-competitive research and de-risk innovation. Taxpayer investment can help drive the necessary infrastructure and foundational research.
- **Shared Resources:** Open-access databases for protein functions, shared cell lines, and model organisms (similar to wheat research) could accelerate progress across the sector.
- **Global Partnerships:** Cross-border collaborations, particularly with countries like India and Thailand, are essential to address global food needs and leverage diverse expertise.

Conclusion

The success of Precision Fermentation and Cellular Agriculture depends on solving technological, regulatory, and societal challenges through a collaborative and sustainable approach. By addressing

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talent shortages, funding gaps, and regulatory inefficiencies, these transformative technologies can move closer to becoming mainstream, helping to meet global food demands in a scalable, affordable, and environmentally sustainable way.

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