Fostering Entrepreneurship for the Bioeconomy (FOEBE): Insights from a course at the European Bioeconomy University

Abstract: The European Bioeconomy University (EBU) is an alliance of eight higher education institutions (HEIs) with a dedicated focus on the bioeconomy. The institutions are from different European countries: Austria, France, Germany, Finland, Italy, the Netherlands, Poland and Sweden. The bioeconomy is that part of the economy that is concerned with the production and manufacturing of biological resources or with providing related services. In the project Fostering Entrepreneurship for the Bioeconomy (FOEBE) from 2020 to 2023, the EBU trained Master students from bioeconomy study programmes in entrepreneurship. FOEBE designed a special entrepreneurship course in which two cohorts of students have already taken part. Teaching methods are blended, both online and in presence. In the first two cohorts, FOEBE found that the course significantly increased students' knowledge and skills in entrepreneurship, while their entrepreneurial orientation – which was already high at the beginning – remained unchanged. Student feedback revealed that a thoughtful composition of teaching methods is important, focusing on interactive methods and providing many practical examples in case studies and field visits. FOEBE will deepen its practices and insights in an extension project until 2026. As few bioeconomy educators have their own experiences with entrepreneurship, FOEBE+ will arrange a collaboration with start-ups and established businesses to make them more confident in teaching.

1. Background - Overview of the European Bioeconomy University and FOEBE

The **bioeconomy** comprises the part of the economy that produces or manufactures renewable biological resources or provides related services. The bioeconomy uses "resources from land and sea, like crops, forests, fish, animals and micro-organisms to produce food, materials and energy".[1] As such, the bioeconomy is a key component of the ongoing "green transition" to a sustainable and circular economy. The transition calls for new approaches and value chains that require entrepreneurs and entrepreneurship training programmes, as the European Commission acknowledges in its bioeconomy strategy.[2]

The **European Bioeconomy University** (EBU) is an alliance of eight leading European universities dedicated to fostering this part of the economy and the green transition through coordinated research, teaching and knowledge transfer: University of Natural Resources and Life Sciences (Universität für Bodenkultur, BOKU, Austria), University of Eastern Finland, AgroParisTech (France), University of Hohenheim (Germany), University of Bologna (Italy), Wageningen University and Research (Netherlands), Warsaw University of Life Sciences (Poland) and the Swedish University of Agricultural Science (Sweden). EBU was founded in 2019 and has a governance structure with a president's board, scientific and operational coordinators, and general meetings. In essence, the alliance works through joint projects, such as FOEBE and a doctoral network funded by Horizon Europe. For instance, the alliance develops courses together and co-supervises PhD students. The alliance considers itself a "think tank for

1 Quoted from https://research-and-innovation.ec.europa.eu/research-area/environment/bioeconomy_en. See the documents at this site for more details about the bioeconomy and the European Commission's bioeconomy strategy and action plan.

2 See European Commission (2018), pp. 87-88.

knowledge generation" and a "creative hub for knowledge transfer"[3] in the entire spectrum of the bioeconomy: "production of renewable biological resources from land and sea, value-adding conversion into feed and bio-based products, economic and social implications of a widespread diffusion of the knowledge-based bioeconomy, including stakeholder engagement and communication". EBU seeks to train a "new generation of truly European graduates, stimulated by state-of-the-art research".

All EBU member universities consider **entrepreneurship education and support** as fundamentally important. They believe that the green transition requires entrepreneurially thinking and acting professionals profoundly trained in sustainability and circular economy issues. To gain deeper insights into how to best design entrepreneurship education for the bioeconomy and to actively train bioeconomy students in entrepreneurship, the EBU universities initiated the project "Fostering Entrepreneurship for the Bioeconomy" (**FOEBE**). It took place from 2020 to 2023 in the framework of the European Commission's Erasmus+ programme. The main task of the project was the design, operation and evaluation of an entrepreneurship course for Master's students in bioeconomy-relevant study programmes. This case study presents some of the most important activities and findings from FOEBE, while the course is continued and further developed.

2. Objectives - Goals of the FOEBE project and the entrepreneurship course

FOEBE "aimed to equip bioeconomy students with tailored entrepreneurial skills and to prepare them to become entrepreneurs or intrapreneurs in the field of bioeconomy".[4] Towards this end, FOEBE designed and implemented an entrepreneurship Master's course that EBU continues in a follow-on project. The learning objectives of this course are to increase the following abilities of students:

- Evaluate the profitability of the business idea and its contribution to a sustainable and circular economy
- Understand the regionality of biomass value chains and their relevance to the business model
- Evaluate the desirability of the business model for social and ecological sustainability
- Assess the sustainability impact of the business model and to communicate the impact to stakeholders
- Understand the target market (customers and demand) and recognise the difference between policy guidance and real demand
- Manage intellectual property of innovative technology
- Create social networks for both business and personal support[5]

FOEBE based these objectives on the assumption that "bioeconomy entrepreneurs need competencies that enable them to assess the desirability and feasibility of a new business idea from both economic and sustainability perspectives".[6] The project derived the objectives from the analysis of recent literature about the development of entrepreneurial mindsets and

3 See https://european-bioeconomy-university.eu/.

4 FOEBE (2023), p. 4.

5 Slightly modified learning objectives from FOEBE (2023), p. 7.

6 Quoted from FOEBE (2023), p. 6.

competencies[7] as well as literature about bioeconomy entrepreneurship.[8] The guiding thought of methods selected according to these objectives was that "students must be prepared to work in multicultural, deadline-driven, result-oriented environments while being able to maintain a good balance in their professional activities to preserve their mental health and their sustainable business for the long run".[9]

3. Input - Resources for teaching the FOEBE entrepreneurship course

FOEBE used co-funding from the Erasmus+ programme, the EU's programme to support education, training, youth and sport in Europe.[10] Conceptually, FOEBE was based on insights from entrepreneurship literature (see previous section) and the European Entrepreneurship Competence Framework (EntreComp), which sees entrepreneurship as a competence – one that applies to all spheres of life, not only to work.

The EBU members contributed to the development, operation and evaluation of the course in different ways: The University of Hohenheim analysed the competencies needed in bioeconomy startups; the University of Bologna examined innovative teaching methods to foster entrepreneurship; the learning designer at AgroParisTech provided material on the students and dropouts, learning objectives and learning methods; and another expert at AgroParisTech reported on the intensive study weeks. The University of Eastern Finland analysed the student feedback. All partners took part in the design, implementation and execution of the online courses and the "intensive study week" that concluded the FOEBE curriculum. BOKU and Wageningen University contributed insights into novel teaching practices while the Warsaw University of Life Sciences coordinated the curriculum design.

4. Activities - Methods and contents of the entrepreneurship course

4.1. Knowledge and skills conveyed

The FOEBE course is optional. Students come from diverse backgrounds, but in general, their MSc programmes have "bioeconomy" in their title – for example: European Master in Biological and Chemical Engineering for a Sustainable Bioeconomy. The universities are gradually integrating it into their Master's or PhD curricula as an elective or core module. In the initial project, the FOEBE course was curricular at the University of Eastern Finland and Wageningen University, bringing students four and two ECTS points, respectively. In the follow-on projects, the universities award on average three credit points. (The course teaches theoretical knowledge for entrepreneurial tasks: idea generation, business planning, intellectual property, sustainable business management, corporate finance, leadership, marketing and digital tools in the bioeconomy context. In addition, students learn and practice practical skills:

- Organise collective work to reach a specific objective (for example a pitching event) within a tight deadline
- Networking
- Ask the right people for help, when necessary to reach a specific goal

7 For example Naumann (2017), Kuratko et al. (2021), Mathisen and Arnulf (2013), Larsen (2022), Kyndt and Baert (2015) and Mitchelmore and Rowley (2010).

8 See Hinderer and Kuckertz (2022).

9 Quoted from FOEBE (2023), p. 8-9.

10 See https://erasmus-plus.ec.europa.eu/about-erasmus/what-is-erasmus.

- Communicate with peers and partners in a clear and efficient manner, using appropriate channels and media
- Delegate the right tasks to the right people
- Seek ideas from other people and implement them when useful
- Adapt the work strategy to sudden changes
- Manage one's emotions when facing a sudden, heavy workload or unexpected situations
- Speak in public or pitch a project confidently

In teaching knowledge and skills, the FOEBE course also considers bioeconomy-specific needs: sustainability assessment and compliance with sustainability standards, circular economy principles to leverage the benefits of bioeconomy innovations, basic knowledge on bio-based value chains and value nets.

4.2. Teaching methods and content

FOEBE implements the course in a blended format. The students access most content on a platform of the online learning tool Moodle. The platform hosts eight modules – see Table below. The online training lasts 16 weeks. It includes online material such as videos as well as online classes and group work. The course ends with an in-person study week gathering 25 to 35 students and educators from the partner HEIs, with a mixture of backgrounds related to business, bioeconomy or both. During this week, students worked on their final projects, putting the knowledge they had acquired during the online course into practice.

The concluding study weeks of the first two courses took place in Warsaw and Bologna. Students formed small groups to prepare a bioeconomy company project from scratch. The educators helped the groups as mentors. At the end of the week, the groups pitched the project to their educators. The groups were advised to present along the FOEBE modules. Business ideas included for example: recycling food waste, reusing furniture, reducing coffee waste, biorefining beverage waste, recycling tires as well as valorising banana, rice or citrus byproducts. Some students developed their ideas further. One student as part of a PhD project, two in start-up companies. One of the start-ups won first prize at the Biobased Innovation Student Challenge Europe (BISC-E) in 2023.[11]

FOEBE entrepreneurship course modules and themes

FOEBE modules	Themes	Pitching instruction
Introduction to bioeconomy	Definition of bioeconomy, sectors of bioeconomy, sustainability of a business	Present your company. How does this project fit the bioeconomy definition, principles, and goals?
Accelerated entrepreneurship	Entrepreneurial opportunity, sustainable entrepreneurship is, business model, business plan, pitch, financial planning, exit strategies	Fill in the triple-layered business model canvas
Design thinking	Innovation, innovation techniques	Explain what type of innovation your invention/company brings to the market
Knowledge management	Intellectual property, intellectual property rights	How will you protect your idea?

11 See https://biconsortium.eu/about-bisc-e#prizes for the prize in general.

Business management and finance	Market entry, business models and circular economy, capital structure and sources	List your sources of income and explain your projected expenses and earnings over the first five years
Leadership and execution	Leadership, teams, followership	Create an ecosystem pie model with at least two actors of your network and your customer
Marketing	Marketing; analysis of strengths, weaknesses, opportunities and threats (SWOT); promotion	Perform a SWOT analysis of your company
Digitalisation and the bioeconomy	Digital transition, sustainability issues	Does your company require specific digital tools, and how sustainable are they?

Source: FOEBE (2023), p. 13

4.3. Course evaluation

In order to collect feedback from the students about the course, the FOEBE educators sent questionnaires before the course, after every online module, and after the completion of the course. The questions were about learning content, methods and learning environment. Moreover, students were asked to assess their own efforts and how well they had reached the learning objectives. Feedback from the first cohort triggered some changes in the second, relating to the organisation of group work, assignment deadlines as well as online tools and forums. For instance, a module on leadership and human resources was entirely redesigned, and the way group work was managed was also improved. An onboarding session focusing on intercultural issues was also added.

5. Stakeholders Involving actors in the entrepreneurship course

Students - FOEBE admitted 35 students to the course in each of the first two cohorts, on average five per university. The universities considered gender balance. Students' ages spanned from the twenties to the forties, representing different stages in life. All students who participate in the FOEBE entrepreneurship course study a bioeconomy-relevant programme. Students attend Master's programmes focused on the bioeconomy, for example agricultural, environmental or forestry sciences. The students have different educational and cultural backgrounds. All students expressed an interest in entrepreneurship and were selected on this interest, but their familiarity with entrepreneurship varies. Some students have already taken entrepreneurship courses, others have not. Moreover, the entrepreneurial ecosystems in the countries of origin vary in terms of regulations or resources available to support innovators or start-ups. Hence, the type of entrepreneurial skills required from graduates may also differ.

The students show a great variety of motivations to take part in the FOEBE course, from personal goals via professional development to tackling global challenges. Exemplary motivations from the first cohort include "contributing to the climate change mitigation", "being in an international environment that gives rise to innovative business ideas" and "personal growth".[12]

Educators - Educators from the seven partner universities, affiliated with their business school or engineering departments, teach the course.

External experts - The course also involved external experts: During the study week's classes and workshops, bioeconomy entrepreneurs lectured the students. Moreover, students could

12 Quoted from FOEBE (2023), p. 11.

visit innovative bioeconomy companies. Examples of companies include Caviro in Italy which pursues wine production in a circular economy model, Ecobean in Poland which turns coffee waste into sustainable chemicals and Chaincraft in the Netherlands which turns food waste into circular chemicals.[13]

6. Impact and lessons learned

6.1. Impacts on students and educators

Out of the 35 admitted students 14 students in the first cohort and 15 in the second answered both the questionnaires before and after the course. The responses indicate that the course increased students' entrepreneurial knowledge and skills, for example, related to marketing and management. On the other hand, entrepreneurial orientation remained unchanged on an already high level. Due to the selection criteria, students had a quite high level of individual entrepreneurial orientation – defined as a combination of risk-taking, innovativeness and proactiveness – when they started the course. However, the surveys showed that the FOEBE course made students consider entrepreneurship from different perspectives more carefully.

At the end of the course, most students stated they had achieved the personal objectives they had had at the beginning.

Impactful activities

FOEBE "asked the students to name specific events in the course that changed their 'hearts and minds' and made them consider becoming an entrepreneur. The students mentioned lectures on different topics, group work, case studies and company visits during the intensive study week. For those who already had entrepreneurship in mind, FOEBE's benefits came in the form of better understanding about marketing, knowledge management and innovation methods, and of the possibility to share knowledge to others interested in entrepreneurship. Learning about startups sparked interest among numerous students. Therefore, company visits were one of the most exciting activities of the course. (…) Being able to see the company from the inside is a great opportunity to begin to understand what it takes to establish a startup company. Tech startups were special attractions to some students since they offer new technology products or services to the markets meeting the modern demands."

Source: FOEBE (2023), p. 19.

6.2. Lessons learned

The participating higher education institutions kept the FOEBE course because it reached its objective of enhancing entrepreneurial skills in students of bioeconomy-related study programmes. So far, the FOEBE educators have learned the following lessons from the entrepreneurship course:[14]

- **Address students' diversity**: Apply a broad toolkit of methods and be sensitive to students' needs, because each student's profile, abilities and ways of learning are unique

[13] See https://www.caviro.com/, https://ecobean.pl/, https://chaincraft.com.

14 See FOEBE (2023), pp. 16 – 19.

- **Ensure good starts**: A good start is important – this applies to the course as such and to every single session. Educators should make sure that openings inspire students and make them work
- **Apply multiple teaching methods**: Student evaluations indicate that they liked a composition of methods to learn by reading, hearing, seeing, and doing things by oneself and in collaboration. They appreciated group work and teamwork. Feedback showed that FOEBE provided a suitable learning environment
- **Involve all in groupwork**: Groupwork implies the challenge to involve everyone, while some students may prefer to take a free ride. FOEBE educators found it important to make every student contribute right from the first group work session and to assign concrete tasks to each student. Clear instructions are important. Allowing students to choose group work subjects themselves may increase motivation. In any case, groups have to fulfil their tasks even if their composition is not optimal
- **Use online teaching thoughtfully**: Students' feedback showed that live online sessions can be effective if they ensure interaction, involving the students and possibly working in parallel groups. Educators should enhance live sessions with slides, videos, quizzes, examples from real life, tests and hints to further digital material. Recordings can help as they allow students to check past sessions
- **Provide business knowledge**: Most students had high expectations for building up their business skills, but little or no prior business knowledge. Hence, it was valuable to provide basic business knowledge related to marketing, leadership and finance in the FOEBE course
- **Socialising event**: Students reported that they liked socialising events very much. Such events contributed to a constructive, creative and inspiring atmosphere in the lessons
- When it comes to lessons specific to the **bioeconomy** arena, the project revealed that few bioeconomy educators have their own professional experience in entrepreneurship, which could help them be confident in teaching it. In FOEBE+, collaboration and networking between different educators and with representatives from startups and established businesses will boost their confidence and increase the exposure of bioeconomy students to entrepreneurship

6.3. Outlook

FOEBE continues. In a follow-on project, FOEBE+ (2023-2026) will enhance and adapt the course and reach out to intrapreneurs and lifelong learners so that even more types of entrepreneurial students can benefit from the courses and contribute to the transition towards a sustainable bioeconomy. The new project also aims to connect nascent entrepreneurs with the entrepreneurial ecosystem in each partner HEI. The third "FOEBE" cohort (that is the first in FOEBE+) began in December 2023. As of 2025, the seven partner universities will recruit larger cohorts of altogether approximately 120 students. FOEBE has approximately 150 applicants for 35 places and seeks to meet this high demand.

7. Source

This case study was prepared by Dr Stefan Lilischkis from empirica Gesellschaft für Kommunikations- und Technologieforschung mbH, Bonn, Germany, through collection and analysis of documentation about the FOEBE project.

The status of information provided in this case study is March 2024.

8. Contacts

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