BRILIAN

Circular Future for Rural Areas

Training and capacity building actions (First report)

Deliverable 7.4 (v1)

WP7 Dissemination and Communication

Circular Bio-based Europe Joint Undertaking

Bio-based Industries Consortium

Co-funded by the European Union

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PU	Public (fully open)	X
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EXECUTIVE SUMMARY

In order to increase the knowledge transfer activities to local stakeholders on bioeconomy, training materials and methodologies will be produced related to BRILIAN's activities. The training material will be rooted in practice and focused on the design of new circular value streams, tailored for farmers and rural communities. Business and models and support regulation developed in WP2, WP3 and WP4 will be fully utilized and offered as replicable good practices. D.7.10 will brief results and feedback from trainings, that is planned in 4 series of thematic webinars tailored to wide spectrum of regional stakeholders in the EU. The topics initially proposed cover in particular: 1) sustainability of the bioeconomy, 2) combining private and/or public funding instruments, 3) the role of governance and stakeholder engagement for an effective bioeconomy, 4) policy alignment: toward a coherent and supportive framework, 5) biorefineries as nodes for rural bioeconomy. The webinars will be uploaded in the BRILIAN website, and all training materials will be integrated in a guidebook.

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LIST OF ABBREVIATIONS AND ACRONYMS

AA – Agritech Academy - Università degli Studi di Napoli Federico II

AAU – Aalborg University

AMS-UB – Alma Mater Studiorum – Università di Bologna

APPA – Association of Renewable Energy Companies

AU – Aarhus University

BC HUB – Basque Circular HUB

BBECs – Bio-Based Education Centres

BIC – Bio-based Industries Consortium

BRILIAN – Cooperative and Sustainable business models for bio-based chains in rural areas

BSAMSUB – Business School Alma Mater Studiorum, University of Bologna

CBE-JU – Circular Based Europe Joint Undertaking

CAP – Common Agricultural Policy

CI –Campus Iberus

CSS –Ciak SI Scienza

D – Deliverable

DALUM – DALUM Academy of Agriculture Business

DoA – Description of Action

DTI – Danish Technological Institute

DTU –Technical University of Denmark

EC – European Commission

EU – European Union

EUD – Energy Technology Development and Demonstration Program

FA – Formacionagronomos.es

FBCD – Food & BioCluster Denmark

GA – General Assembly

GDP – Gross Domestic Product

GUDP – Green Development and Demonstration funding program

GVA – Gross Value Added

HEU – Horizon Europe – the 9th framework Programme of the EC for research, technological development and innovation activities

IAP – Implementation Action Plan

IBS – Italian Bioeconomy Strategy

INE – National Statistics Institute

IoT – Internet of Things

ITS – Intelligent Transformation Systems

JU– Joint Undertaking

KUDK –University of Copenhagen

LUISS – Business School L.U.I.S.S. - Free International University of Social Studies

Maas – Mobility-as-a-Service

MBC – Master Biocirce

MRU – Nordic Council of Ministers for Education and Research

MUDP – Danish Environmental Technology Development and Demonstration Program

NFCs – Non-Food Crops

NEET – Not in Education, Employment, or Training

PC – Project Coordinator

PUM – Polytechnic University of Marche

SSSAP – Scuola Superiore Sant'Anna of Pisa

SDGs – United Nations' Sustainable Development Goals

SME – Small and Medium Enterprise

TI –Teknologisk Institut

UCLM – Universidad de Castilla-La Mancha

UNINETTUNO –UNINETTUNO University, CRIS

UPC – Universitat Politecnica de Catalunya

UP – Universidad de Almería

UPNA – Universidad Publica de Navarra

UPM – Universidad Politécnica de Madrid

UPV – Universidad del País Vasco

UR – Universidad de la Rioja

UT – University of Tuscia

UZ – Universidad de Zaragoza

VET – Vocational and Educational Training

WP – Work package

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INTRODUCTION

Deliverable 7.4 *Training and capacity building actions (First report)* is part of Task 7.4 *Capacity buildings set-up and implementation (M1-M48)*. The task aims to develop the training material and methodology for increasing the knowledge transfer activities to local stakeholders on bioeconomy focusing on eastern Europe regions and it is coordinated by the BIOEAST HUB CR. Focusing on rural communities, this task will valorize the knowledge produced in WP2, WP3, WP4 and keys for success and lessons learned from the pilots' experience (WP5). More specifically, knowledge on the pilot business models in Spain, Italy and Denmark and support regulation all of which can work as replicable best practice cases in terms of circular business modeling, resilient production systems and stakeholder engagement. The trainings will be launched via 4 series of thematic webinars with the components of the 1-day face-to-face training course aimed to an audience as wide as possible (regional stakeholders across Europe). The capacity modules proposed based on the identified local stakeholder needs in WP2 are i) Sustainability of the bioeconomy ii) Combining public and/or private funding instruments iii) The role of governance and stakeholder engagement for an effective rural bioeconomy iv) Policy alignment: towards a coherent and supportive framework. v) biorefineries as nodes for rural bioeconomy. The webinars will be uploaded in BRILIAN website, and all training materials will be integrated in a guidebook. Overall, D7.4 contributes to the entire WP7. More specifically, Task 7.2 *Dissemination and Communication Actions* will be valuable both in communicating the capacity building activities and in disseminating the results to all related stakeholders through its communication channels. By using tools provided by the Dissemination and Communication area, like the dedicated section on the website (https://brilian.eu/trainings/), the news and events section, the info-packs tailored for trainings, and the utilization of social networks, T7.4 can assist to reach a broad audience and maximize the project's outreach.

D7.4. *Training and capacity building actions (First report)* comprises the first part of the task and sets the scene and methodology to develop the training materials and actions throughout the project. In order to (i) assess status quo of the knowledge transfer activities concerning local stakeholders on bioeconomy in the BRILIAN regions-countries, and (ii) collect existing knowledge that can be utilized later in BRILIAN training, the following actions were realized: **Mapping**: A Questionnaire was formulated and discussed with project partners in September 2023 and finalized during October 2023 (the final version is provided in Annex 1). The aim was to scan the national and regional knowledge reservoirs to provide information on the bioeconomy sectors,

trends, current training opportunities, governance in education, good practices, and required working skills. The research was not limited to the national level as it was important to showcase also local opportunities, local characteristics, good examples and show how BRILIAN can enrich knowledge focused on local communities. BRILIAN partners collected the information accordingly till the end of November 2023. The results of the mapping are showcased in Chapters 1, 2, 3 & 5. In this document, BHCZ analyzed the responses and provided a brief overview of each region in an effort to identify common needs and opportunities that can be addressed by the solutions provided by BRILIAN.

Materials collection: Through the aforementioned questionnaire, partners also provided information on national and regional educational programs along with materials that can be useful for BRILIAN's trainings and materials developments. The results are presented in Chapters 3 & 5. In Chapter 3, references at national and local level are indicated regarding the available training opportunities and the analysis is presented in Chapter 4 summarizing the main conclusions and findings. In Chapter 5 materials, platforms and open access information provided both in the pilot countries/regions and across the EU are listed. An initial thematic categorization is conducted to facilitate further processing and valorization of the information in a flexible way.

Methodology for the training development: Chapter 6 provides guidelines and instructions for the development of the training activities along with a rough timeline that follows the project results.

Cooperation: In order to forge strong collaborations and enrich educational opportunities for BRILIAN's audience, contacts have been launched with other CBE - JU or HE projects developing similar activities. Given the different maturity of each project, the joint activities developed so far and envisaged vary (Chapter 6).

Target audience: The task is mostly addressing rural communities and regional stakeholders along with other similar interest groups described in Chapter 6.

Next steps and expected results: The findings in this document and contacts with other projects will be fully utilized at a later stage. When knowledge and non-confidential exploitable results from the pilots will be sharable to the public the trainings will be organized, and user-friendly training materials will be developed and showcased in the BRILIAN website after the realization of the trainings. This way the exploitation of BRILIAN solutions and business models will be supported. The results of the efforts throughout the project will be summarized in the D7.10 Deliverable Training and capacity building actions (Final version) (M48).

1. BIOECONOMY IN BRILIAN REGIONS

The first chapter provides an overview of the contextual situation in each of the BRILIAN interest regions. The following aspects are described for each region: bioeconomy performance, significant sub-sector or value chains, key trends within the bioeconomy sector, and expected key sub-sectors or value chains by 2030. In every case, first a national perspective is offered which is then enriched with region specific information whenever available to showcase good practices for other rural areas and to check the national-regional dynamic.

1.1 SPAIN

1.1.1 Bioeconomy performance, important subsectors & bio-based value chains

Overall, Spain's bioeconomy sector is characterized by a multi-faceted approach that encompasses sustainable practices, circular economy initiatives, technological innovation, and policy support. These efforts not only contribute to environmental sustainability but also foster economic development and competitiveness in the global bioeconomy landscape.

More specifically:

1. **Food production** is a prominent sector to the Spanish economy: the farming sub-sector generated Gross Value Added (GVA) of €21.707 billion, 2.5% of national GDP, pursuing its activity in 890,000 operations and employing 740,000 people (Lainez et al., 2018). GVA in the food industry sector was €28,448 billion in 2012, accounting for 2.7% of GDP, with a total of 28,762 companies and providing direct employment of 480,000 people (Lainez et al., 2018) Ministry of Agriculture, Fisheries and Food).
2. **The forestry sector** plus the timber, cork and pulp and paper industry generated GVA of €5936 billion, 0.56% of national GDP. From this total, €3307 billion were derived from the pulp and paper industry, €1867 billion from the timber and cork industry, and €762 million from the forestry sector (Lainez et al., 2018).
3. **The fisheries sector** is also relevant, comprising offshore fishing as well as continental and marine aquaculture, and generating GVA of €1047 billion, with 5025 operations in all, 9871 vessels and 64,675 jobs contributing about 0.2% to GDP (Lainez et al., 2018)

4. **Biotechnology & R&D:** According to the National Statistics Institute, INE (Lainez et al., 2018) the non-health biotechnology sector is made up of 2831 companies employing 172,939 staff of whom 9135 are engaged in R&D in biotechnology, and with 5148 researchers. As many as 530 companies are working in R&D related to bioeconomy: 196 in animal health and aquaculture, 314 in food, 206 in agriculture and forestry production, 182 in the environment and 159 in industry (Ministry of Agriculture, Fisheries and Food).
5. **Bioenergy:** Last but not least, the sector producing and transforming biomass for energy generation and creating bioproducts comprises some 170 companies in Spain. According to the Association of Renewable Energy Companies (APPA) (Lainez et al., 2018), the input to GDP from bioenergy, including biomass for the generation of electricity and thermal and biofuels for transport between 2007 and 2014 averaged €3562 billion each year. In that period, some 47,880 direct and indirect jobs were generated annually on average according to the same sources.

A regional reflection of the in the overall national picture can be found a region of particular interest to the Spanish pilots' activities. The Ebro Valley, known for its strong agricultural sector, contributes significantly to the bioeconomy through sustainable agriculture, agri-food processing, fisheries, and forestry. Biotechnology and bioenergy research, environmental services, and the development of renewable energy projects further enrich the bioeconomy landscape.

1.1.2 Key trends, sub-sectors, value chains by 2030: Influence on innovation and investments

In Spain, the bioeconomy sector is undergoing significant transformations, driven by regional initiatives and trends. At the national level, Spain launched its own bioeconomy strategy in 2016, (Lainez et al., 2018) focusing on the sustainable and efficient use of biological resources. This strategy underscores the importance of sectors like agri-food, biotech, and biomass, highlighting the need for technologies that enable the valorization of various industrial side streams. By 2030 (Spanish Government, 2016), the bioeconomy is expected to thrive across various sub-sectors and value chains. The agriculture and food industries, forestry, fisheries, non-health biotechnology, and biomass energy sectors all play a significant role and are supporting the increase of bioeconomy performance. **These sectors generate substantial economic value and employment opportunities, highlighting the importance of bioeconomy** to the national economy. Investments in research and innovation further drive advancements,

positioning Spain as a leader in bioeconomy-related fields and ensuring continued growth and sustainability in the years to come.

Applying the above on a regional level, in the Ebro Valley, bioeconomy trends are shaped by a variety of factors. **Sustainable agriculture practices are gaining traction, with farmers adopting technologies like IoT sensors and data analytics** to optimize crop management. **Circular economy principles are also being embraced, particularly in the agri-food and food processing sectors**, leading to innovations in waste-to-value technologies and investments in recycling initiatives. By 2030, **sustainable agriculture, leveraging practices like precision agriculture and organic farming, will play a vital part**. The agri-food and food processing sectors will maintain importance, with a focus on innovation in processing, packaging, and waste reduction. Circular economy initiatives will be crucial across industries, minimizing waste and promoting recycling and upcycling.

Additionally, the region is witnessing a growing utilization of **biomass for renewable energy generation,** alongside efforts to conserve biodiversity and ecosystem services. Biodiversity conservation, sustainable water management, green building, food traceability, and agro-tourism are also expected to contribute significantly to the bioeconomy in the region. **Research and innovation clusters further drive development in bioeconomy-related fields and are expected to attract investment and foster collaboration between public and private sectors**. An example from the private sector is PATURPAT (Spanish Food Company, Basque Country), BRILIAN Spanish pilot case. The company reflects Spain's commitment to advancing circular economy principles across sectors. By aiming to improve water management and reduce waste while valorizing side streams form their process, PATURPAT emphasizes innovation in renewable materials, prolonging product shelf life, and promoting the reutilization, recycling, and recovery of waste materials.

1.2 ITALY

1.2.1 Bioeconomy Performance, important subsectors & value chains

In Italy, the bioeconomy encompasses various sub-sectors and value chains. that contribute notably to the nation's economic and employment landscape. According to (Intesa Sao Paolo, 2023), the set of activities related to the Bioeconomy in Italy generated an estimated output of 415.3 billion euros, employing about two million people. Here are the key sectors as identified in this study (European Commission,

Directorate-General for Research and Innovation,Delloitte,Empirica,Fondazione Giacomo Brodolini, 2022):

1. **Agriculture**: This is the largest bioeconomy sector in terms of value added and employment, reflecting its foundational role in the bioeconomy. Agriculture is crucial for producing renewable biological resources and for sustainable food production. Italian Bioeconomy Strategy (Italian Government, 2017) highlights the agrifood as it includes agriculture, forestry, biobased industry, and marine bioeconomy, engaging in activities from harvest to final products.

2. **Forestry:** Although smaller compared to agriculture, forestry remains vital, contributing to sustainable forest management and production, IBS is highlighting sustainable management of forest resources.

3. **Fishing and Aquaculture**: These sectors contribute to the bioeconomy by providing sustainable fishery and aquaculture products. IBS is addressing valorizing marine and rural biodiversity through new value chains that implement sustainable and circular production models.

4. **Bio-based Chemicals, Pharmaceuticals, Plastics, and Rubber**: These industries are significant due to their innovative use of biological resources to produce a wide range of bio-based products.

5. **Bio-based Electricity and Liquid Biofuels:** These sectors are emerging as important components of the bioeconomy, focusing on renewable energy sources derived from biological materials.

6. **Biobased Textiles, Food, Beverage, and Tobacco**: These traditional industries are integral to the bioeconomy, transforming biological resources into a wide array of products.

7. **Wood Products and Furniture:** This sector utilizes wood, a renewable resource, to produce goods, contributing to both economic value and sustainable practices.

Other interesting value chains falling into the aforementioned categories are paper, pulp, leather, bioherbicides, bio lubricants, and biodegradable ingredients for cosmetics. Notable players in the region include companies in the field of biotechnologies, and various organizations focusing on agri-food, forestry, marine research, pharmaceuticals, and automotive industries.

Reflecting the national situation on a regional level, we can look into the example of Campania. There, key subsectors include the agri-food (agri-tech), forestry, biotechnologies (with Novamont having a research and development center in Piana di Monte Verna), marine research (such as Stazione Zoologica Dhorn), pharmaceuticals (including Campania Bioscience and CEINGE), and automotive sectors. With various organizations contributing to innovation and development in bio-based industries, a dynamic bioeconomy scene is set with the Campania region representing 19.6% of the economy in the South of Italy.

1.2.2 Key trends, sub-sectors, value chains by 2030: Influence on innovation and investments

In Italy, the bioeconomy sector is influenced by several key trends that significantly impact innovation and investments. The National Bioeconomy Strategy was updated in 2019 (Italian Government, 2019). This strategy is designed to achieve a 15% increase in the turnover and employment of the Italian Bioeconomy by 2030 and focused on Key Sectors agrifood, green chemistry, and circular economy. Biorefining technologies are considered very important as they are expected to advance, transforming renewable natural resources into bio-based products. This includes leveraging waste and agricultural residues, indicating a move towards more sustainable production methods and a reduction in environmental impact (European Commission, Directorate-General for Research and Innovation,Delloitte,Empirica,Fondazione Giacomo Brodolini, 2022). By 2030, compostable plastics are expected to remain a significant sub-sector within the bioeconomy. **The presence of important industrial actors has established a consolidated supply chain, strong connections with stakeholders in organic waste management and agriculture; the legislation is also supportive**. **This justifies the sustained demand for labor in the bioeconomy sector.** The biodegradable and compostable plastics industry in Italy is projected to continue its growth. A study conducted by (Plastic Consult, 2023) indicates the presence of 271 companies in 2022 engaged along the value chain, with 3,005 dedicated employees, 127,950 tonnes of compostable products produced, and a total turnover of 1,168 million euros in 2022, this sector is expected to expand further by 2030.

The (European Commission, Directorate-General for Research and Innovation,Delloitte,Empirica,Fondazione Giacomo Brodolini, 2022) study identified the following challenges and opportunities of the bioeconomy education in Italy: There is a need to consider rapid skill changes and the need for the educational institutions to adapt quickly enough to meet new demands, potentially leading to a skills gap between

what is taught and what the industry needs. It is, however, a situation very common in other EU countries, too. Additionally, there is a need for a stronger integration of interdisciplinary learning that combines various fields such as biotechnology, environmental sciences, and economics. While some bioeconomy education programs offer entrepreneurship training, it is not sufficiently widespread. Enhancing entrepreneurial skills is vital for fostering innovation and the commercial application of bioeconomy research, this is also a sad reality in many EU countries.

1.3 DENMARK

1.3.1 Bioeconomy Performance

Denmark's bioeconomy is a crucial driver of its GDP. Key industries within this sector include:

1. **Agriculture:** Denmark's bioeconomy encompasses various sub-sectors and value chains, including agriculture, renowned for its focus on sustainability and high-quality food production. Danish agricultural practices claim around 63.7% of the country's land, putting it among Europe's most intensively cultivated countries.
2. **Food, beverage and tobacco product manufacturing:** The manufacture of food products, beverages and tobacco products, contribute to more than 10% of the bioeconomy´s GDP; The food sector in Denmark is also excelling in food ingredient production. Measures to bolster circularity in the food system range from more sustainable, regenerative farming methods and technologies to shifting the dietary habits of Denmark's residents to more plant-based ones.
3. **Basic pharmaceuticals, and wholesale trade (excluding motor vehicles and motorcycles), all of which significantly bolster GDP.** The manufacture of basic pharmaceuticals products and pharmaceutical preparations, around 10% as well; and the wholesale trade, except for motor vehicles and motorcycles. (Kuosmanen T et.al, 2020)
4. **Biotechnology:** The biotechnology industry is thriving, particularly in biopharmaceuticals and vaccines.

Investments in biofuels, biomaterials, waste management, recycling, sustainable forestry practices, aquaculture, fisheries, environmental technologies, and research and innovation further contributes to strengthen Denmark's position as a leader in the bioeconomy, driving economic growth, sustainability, and innovation. The bioeconomic performance of the whole country is connected to the Danish BRILIAN

pilot, especially in agriculture and food production, as farmers across the country are engaged in the activities.

1.3.2 Key trends, sub-sectors, value chains by 2030: Influence on innovation and investments

In Denmark, the bioeconomy is advancing through the adoption of cascading use methods, championed by institutions like the Technical University of Denmark (DTU) and the Danish Technological Institute (DTI). **This approach, advocated by key organizations across different bioeconomy sectors, optimizes the value of side streams and supports enterprises in broadening their product portfolios, enhancing business cases for novel products and technologies, and achieving greater sustainability. By promoting cascade utilization of new raw materials or unexplored side streams, companies can reduce dependency on singular products and expedite economies of scale, reinforcing the biorefining sector with new investments from both private and public organizations.** Additionally, Denmark is witnessing a growing interest in "blue" biomass, such as fish, shellfish, and seaweed, as viable alternatives to traditional land-intensive food production methods, thereby alleviating pressure on land resources. (Aarhus University, 2021) This shift towards sustainable practices, including the cascade use of raw biomaterials and exploration of non-land requiring resources, represents a significant trend in Denmark's bioeconomy evolution, shaping multiple value chains and fostering innovation within the sector.

By 2030, Denmark has set ambitious targets to achieve a 70% reduction in greenhouse gas emissions (KPMG, 2021), focusing on key sub-sectors within the bioeconomy as outlined by the Danish (National Bioeconomy Panel, 2022) and supported by governmental initiatives. These sub-sectors encompass various strategies aimed at leveraging renewable resources and innovative technologies to drive sustainable development and combat climate change. Firstly, there's a concerted effort towards adopting "Power-to-X" technologies, aiming to convert renewable energy into synthetic fuels or other valuable products. Secondly, there's a push for the widespread implementation of green biorefineries, prioritizing microbial and enzymatic processes to extract maximum value from bioresources efficiently. **Moreover, Denmark aims to increase the utilization of bio-resources from Danish regions by up to 10 million tonnes of dry matter. A significant portion of these bioresources will be processed through biorefining technologies, aiming to maximize resource potential, recycle nutrients, and foster new growth and export opportunities as a contribution to the growth of the food sector.** Furthermore, the development of biorefining and fermentation

technologies is emphasized across various sub-sectors, including plant-based food and ingredients, feed, fertilizers, crop protection agents, and components for bio-based materials and CO_2 capture and storage.

Finally, the utilization of remaining fractions after maximum cascade use in the biogas sub-sector further enhances resource efficiency and overall sustainability, underlining Denmark's commitment to leading the transition towards a more sustainable and resilient bioeconomy. By 2030, the aim is to diminish the environmental, natural, and climate impacts originating from production areas, while also allocating land for conservation and biodiversity efforts.

2. GOVERNANCE IN BIOECONOMY EDUCATION

The second chapter is summarizing the governance model in each BRILIAN region, showing how local strategies can influence bioeconomy activities and therefore the knowledge produced or required in each field. The chapter is examining the existence of policies or strategies regarding (adult) education on (circular) bioeconomy, or on the wider topic of sustainability, in particular any regional bioeconomy strategy and the role of national, regional and local institutions in bioeconomy education.

2.1 SPAIN

2.1.1 Policies and strategies of bioeconomy education

Sustainable education, particularly in the realms of circular bioeconomy and broader sustainability principles, are anchored in a multi-level governance framework. At the national level, the government has implemented a comprehensive strategy aimed at fostering a circular economy ethos throughout society. This strategy, outlined in the National Circular Economy Strategy, emphasizes the pivotal role of education and training in cultivating a workforce equipped with the knowledge and skills necessary to drive sustainable development. Therefore, in alignment with the United Nations' Sustainable Development Goals (SDGs), Spain is committed to integrating sustainability principles into education at all levels. Adult education programs, designed to address SDGs such as responsible consumption and production, form a crucial component of this initiative.

Regionally, the Ebro Valley government has tailored strategies to suit local contexts and priorities. The region develops its own educational initiatives, often in collaboration with local stakeholders, to address specific challenges and opportunities related to sustainability. This particularly reflects the Education for Sustainable Development Strategy of the Basque Country 2030 goals, which is targeting students in order to ease the adoption of further sustainable development measures. The focus is mainly on sustainability rather than circular bioeconomy itself. Below, the 4 goals of the strategy are introduced along with the lines of action which are more relevant to adult training and education (Ihobe, n.d):

GOAL 1: EDUCATION FOR ACTION - *Facilitate collaborative networking of the stakeholders that work in Education for Sustainable Development.*

GOAL 2: STRENGTHENING THE CAPACITY OF EDUCATORS, TRAINERS AND OTHER AGENTS OF CHANGE - *Train educators to be change and learning facilitators & Train agents of change in sectors other than education.*

GOAL 3: TRAINING AND EMPOWERING YOUNG PEOPLE - *Showcase the role of the university and vocational training centres as youth empowerment platforms as regards sustainable development.*

GOAL 4. PROMOTION CITIES AND TOWNS AS EDUCATIONAL SETTINGS FOR SUSTAINABLE DEVELOPMENT - Drive and energize the Education for Sustainable Development activities promoted and implemented by local stakeholders.

2.1.2 Role of the national, regional and local institutions

Vocational and technical training institutions, play a pivotal role in delivering specialized courses on sustainable agriculture, renewable energy, and green building, with durations ranging from several weeks to a year, depending on the complexity of the program.

Local municipalities and community organizations further enrich the educational landscape by offering tailored courses and workshops. These grassroots initiatives, responsive to the unique needs of local residents, complement broader regional and national efforts, fostering a culture of sustainability from the ground up. Fees for these programs vary depending on factors such as duration, course content, and the funding available from local governments and organizations.

Crucially, public-private partnerships serve as catalysts for innovation and skill-building in the circular bioeconomy and sustainability sectors. By forging collaborative ties between educational institutions and private enterprises, Spain fosters an ecosystem wherein businesses actively contribute to workforce development through training, internships, and apprenticeships.

2.2 ITALY

2.2.1 Policies and strategies of bioeconomy education

The Italian Bioeconomy Strategy (BIT II) (Italian Government, 2019) outlines a comprehensive approach to education and training in the field of bioeconomy, encompassing various key recommendations and programs. The goal is a 15% increase

in turnover and employment in the Italian bioeconomy by 2030. These initiatives include:

1. Supporting cross-disciplinary education and training for researchers and technical careers, ensuring a well-rounded understanding of bio-based principles and practices.
2. Coordination between Ministries (Ministry for Economic Development (co-coordination), Ministry for Agricultural, Food and Forestry Policies, Ministry for Education, University and Research, Ministry for the Environment and Protection of Land and Sea, Conference of Italian Regions, Territorial Cohesion Agency, National Technology Clusters for Green Chemistry (SPRING) and the agri-food sector (CLAN)), and Italian regions in alignment of policies, regulations, R&I funding programs and infrastructures investment.
3. The institution of the Italian "National Bioeconomy Coordination Board" (CNBBSV), aimed at promoting the policy dialogue of all Ministers in the Bioeconomy perimeter and with the region, together with experts and representatives of the private sector.
4. SPRING, the Italian technological Cluster of Circular Bioeconomy, is key element to connect the worlds of university, industry and institution.
5. Developing a coherent policy framework and regulations to promote biobased products, education, training, information, and communication within the bio-based sector.
6. Updating education programs to be multi-sectorial and transdisciplinary, fitting for the evolving and productive needs of bioeconomy and bioindustries. This includes the revision of academic and advanced-education programs while fostering initiatives for the education and professional training of new bioeconomy specialists.
7. Collaboration with private actors, industrial, and agricultural.
8. Providing dedicated training courses to local administrations to support their knowledge and competences on bioeconomy and expertise acquisition.
9. Enhancing regional coordination, promoting policy harmonization, and sharing best practices to bolster bioeconomy education and training nationwide.

Overall, BIT II underscores the importance of comprehensive educational initiatives and strategic partnerships to nurture a skilled workforce and advance the bioeconomy agenda in Italy.

2.2.2 Role of the national, regional and local institutions

The **National Bioeconomy Coordination Board** developed the Implementation Action Plan (IAP 2020-2025) for the Italian Bioeconomy Strategy BIT II, including, among others, a series of relevant targeted actions. (Italian Government, 2019) Action 4 is named "Promote engagement, education, skills upgrading, attitude, training, and entrepreneurship across the Bioeconomy". In this section the IAP, which is now under revision and update, specifies the importance of launching a "Sustainable Bioeconomy" Information System, as entry point for sharing information on state and development of the main national sustainable Bioeconomy actions. It is also focused on actions such as promoting citizens and companies awareness and engagement through campaigns; improving the level of training and education of personnel working in the Italian agricultural, forest and marine/maritime sectors; including the Bioeconomy both in school education and specialist vocational courses; creating new Bachelors and Masters' University degree programs in Bioeconomy and better promote the existing ones; supporting Open Innovation initiatives to accelerate a scale-up of innovative solutions; acting to increase the EU financial support to Bioeconomy projects.

Academic institutions: In Italy, adult education and lifelong learning opportunities are extensively supported, especially in areas aligned with the bioeconomy. Italy offers a variety of educational programs focusing on manufacturing, agriculture, sustainability and other bioeconomy-related fields. These programs are available across **numerous universities** and include bachelor, master, and doctoral levels, with a significant focus on master's programs. Available in higher education institutions, **such as Sapienza University and the University of Siena**, entrepreneurship training is part of the curriculum, aiming to foster a spirit of innovation and self-starting in the bioeconomy sector. Increasing the collaboration between educational institutions and industry can enhance the practical experience of students and ensure the relevance of the curriculum to the industry's needs and can further emphasizing lifelong learning to help current professionals adapt to new developments in the field.

2.3 DENMARK

2.3.1 Policies and strategies of bioeconomy education

Denmark doesn't have a dedicated strategy for Bioeconomy development yet. However, the country is part of the macro-regional bioeconomy strategy "A bioeconomy for the Baltic Sea Region (2014) and "Nordic Bioeconomy (2018)" which features a Nordic

Council for Ministers for Education and Research (MR-U), without specific reference to bioeconomy education, though. (European Commission, 2023).

2.3.2 Role of the national, regional and local institutions

On the national level, the (National Bioeconomy Panel, 2022) has been given the mandate to offer recommendations to the government concerning the advancement of the bioeconomy in Denmark. These recommendations are crafted to enhance the economy while giving priority to factors such as **employment,** environmental preservation, biodiversity, and climate considerations. On its behalf, the Danish Government is providing a lot of funding for education, in particular for the biorefining sector encompassing both green and brown biorefining. This indicates the need to prepare experts, including those with short-term, medium-term, not only high-level education, who will possess the skills required by the industry.

Food & BioCluster Denmark (FBCD) assumes a pivotal role in overseeing the food and bio-sector in Denmark. Through the establishment of networks and the initiation of new projects, FBCD endeavors to educate companies on sustainability and encourage their participation in the circular bioeconomy. In this case, we see that political goals and decisions indirectly affect educational needs.

Supported by the Danish Ministry of Research and Education, FBCD strives to drive positive change within the industry. Four groups from Danish universities, including DTU Biosustain, DTU Bioengineering, KU-Food, and KU-Biosolutions (Kalundborg), are actively involved in educating candidates within the bioeconomy domain.

3. TRAINING IN BIOECONOMY

The third chapter is scanning available bioeconomy related training opportunities in the regions. Even though the bioeconomy education could start as early as primary school, and later be embedded in both secondary schools and universities curricula, BRILIAN is focusing on lifelong learning and Vocational and Educational Training (VET) as for adults and professionals to match the pilot's needs (i.e. the requirement of the circular bioeconomy job market, SMEs as value chain actors and training for policy makers). This chapter collects information for the BRILIAN regions and summarizes their commonalities and differences. In each BRILIAN region the following topics were examined:

- Main training, retraining and lifelong learning opportunities in circular bioeconomy (or in broader sense sustainability) available for adults (resp. professionals) in details (level, form, target group).
- Existence of current targeted research enquiring bioeconomy skills (gaps and needs) and the outcomes.
- Conclusions extracted in terms of gap in skills if any that are needed in the regions considering its bioeconomy trends, key sub-sectors, and value chains, specific stakeholder groups and requirement of any specific skills.

3.1 SPAIN

3.1.1 Adult education and lifelong learning opportunities

In general, Spain offers a variety of opportunities in the field of circular bioeconomy or sustainability. **Key target groups are both university students and employees, the latter mainly attending on-line training**. Interestingly, Spanish language prevails, and the national dimension of bioeconomy is accented. Bioeconomy education is available on the national level (there are only a few regional programs), the vast majority are academic and provided by universities, and there are also organizations that provide education through seminars. A list including some of the available academic programs can be found in Table 1.

Table 1 List of Educational programs related to Circularity and Bioeconomy in Spain

Academic Programs					
University	Name	Language	Level	Attendance	Link
Universidad Politécnica de Madrid	Agro-Environmental Technology for a Sustainable Agriculture	SP	National	On campus	UPM
	Ecosystem Restoration (MER)	SP	National	On campus	UPM
	BSc Degree in Agricultural Sciences and Bioeconomy	SP	National	On campus	UPM
	Project Planning for Rural Development and Sustainable Management	SP	National	On campus	UPM
	Circular Economy Especiality Consum and Sustainable Management of Natural Capital	SP	National	On campus	UPM
	Uses and Management of Water Resources in the Natural Environment	SP	National	On campus	UPM
Universidad de Zaragoza	Master's in Circular Economy	SP	National	On campus	UZ
Universitat Politecnica de Catalunya	Circular Economy tools and strategies for sustainable business transition	SP	National	Hybrid	UPC
Universidad Publica de Navarra	Master's in Circular Economy	SP	National	On campus	UPNA
Universidad de la Rioja	Master's in Circular Economy	SP	National	Blended learning, in the 4 Campus Iberus Universities	UR
Universidad del País Vasco	Circular Economy: Business application	SP	National	On campus	UPV
Campus Iberus	Master's in Circular Economy	SP/ some EN materials	National	On campus	CI
Universidad de Almería	Master degree in circular bioeconomy and sustainability	SP	National	On campus	UA

Universidad de Castilla-La Mancha	Master's expert to create a company on the forestry bioeconomy sector	SP	National	On campus	UCLM
Basque Circular HUB	Training in bioeconomy	SP	Regional (Basque)	On campus	BC HUB
Formacionagronomos.es	Online course related to bioeconomy and sustainable development	SP	Regional-National	Online	FA

3.1.2 Required regional Bioeconomy skills.

Some of the most required skills in today's Spanish job market are: **circular economy expertise, sustainable agriculture - precision agriculture knowledge, renewable energy specialization, policy and regulatory expertise, and cross-sector communication skills.** It is worth mentioning that up to the conduct of this document, there is a lack of data based on dedicated research regarding the most essential bioeconomy skills in Spain, particularly from the job market point of view. This data would be extremely important to gather in order to bridge the gap between education and the labor market, and to create incentives for people to engage in the bioeconomy sector. There's an extensive effort from projects to map the necessary market skills, although the results are often fragmented. However, the following soft skills were identified as important during research among many educational institutions for the BIOBEC project, including Spanish institutions:

- Analysis of complexity;
- communication and interdisciplinary communication;
- cooperation;
- creativity;
- decision making;
- entrepreneurship;
- flexibility to deal with uncertainties;
- innovation thinking;
- management;
- problem-solving;
- teamwork.

Still, it looks like apart from technical skills, bioeconomy requires the acquisition of interdisciplinary and cross sectoral ones, including work -rather than academic skills-like the aforementioned soft skills. (Barrera-Corominas, Gairín, C., & et.al, 2022) This could work as an overall comment regarding the educational needs for Spain or even regionally, for the Basque country. Although there's an intensive need to include sustainability in the curriculum of different educational levels, bioeconomy requires special cooperation and interdisciplinarity to work efficiently. Positively, the Basque government has issued a plan for vocational training (Governement of the Autonomous Community of the Basque Country, Ministry of Education, 2022), also including bioeconomy, but mostly through the energy transition prism. Supporting vocational is a trend that is worth enhancing with more topics.

3.2 ITALY

3.2.1 Adult education and lifelong learning opportunities

Regional research conducted by BRILIAN partners regarding the local availability of bioeconomy trainings revealed that more opportunities are provided at a national rather than on a regional level. The majority of the educational programs were provided by academic institutions and no vocational training options were identified. In terms of attendance and accessibility, both on-site and hybrid or online options were available, partially following the distance learning trend. Most courses are provided in Italian. Available educational programs are described in more detail in Chapter 5.

Table 2 List of Educational programs related to Circularity and Bioeconomy in Italy

Academic Programs					
University	Name	Language	Level	Attendance	Link
Alma Mater Studiorum – Università di Bologna	The new plastics economy: circular business models and sustainability	EN	Int/al	Online	AMS -UB
Ciak SI Scienza	Company providing VET for businesses	EN	Int/al	-	CSS
Agritech Academy - Università degli Studi di	VET training for professionals	IT	National	-	AA

Napoli Federico II					
University of Tuscia	Master's degree program in circular economy	EN	National	On campus	UT
Polytechnic University of Marche	Master's degree program in sustainability management and circular economy	IT – some seminars in EN	National	On campus	PUM
Business School L.U.I.S.S. - Free International University of Social Studies	Executive master's degree in circular economy management	IT – some seminars in EN	National	On campus (weekends) designed for professionals	LUISS
Scuola Superiore Sant'Anna of Pisa	2nd level master's degree in circular economy and resource efficient management	IT	National	On campus	SSSAP
UNINETTUNO University, CRIS	Master's level I in Circular Economy 4.0 – Energy, technology and Environment	IT	National	Hybrid	UNINETTUNO
Business School Alma Mater Studiorum, University of Bologna	Executive master's degree in sustainability and business innovation	IT	National	Online	BSAMSUB
4 Universities, 4 companies and 2 Italian Technological Clusters	Bioeconomy in the Circular Economy (BioCirce)	EN	National	Hybrid	MBC

3.2.2 Required regional Bioeconomy skills

For the enhancement of the bioeconomy in Italy, there are specific required skills identified in the (European Commission, Directorate-General for Research and Innovation,Delloitte,Empirica,Fondazione Giacomo Brodolini, 2022) study:

1. Research and Development Skills to innovate and improve upon existing bio-based solutions.
2. Data Science and Analytics for optimizing production processes and enhancing product development through the intelligent use of large volumes of data.
3. Sustainability and Circular Economy Knowledge to promote sustainability and circularity.
4. Management and Leadership and entrepreneurship skills to identify market opportunities and develop new business models within the bioeconomy sector,
5. Technical Skills in Bio-based Industries and digital competence to understand machinery are key for technical roles within the industry.
6. Digital Competence: Familiarity with digital tools and technologies, which are increasingly integrated into bioeconomic processes for improved efficiency and innovation.

Additionally, the bioeconomy sector demands a broader variety of skills like legal expertise to evaluate the innovation regulatory framework and needs, economic analytic thinking, communication skills, and language proficiency especially in English. Key stakeholders interested in these skills include companies involved in circular bioeconomy initiatives, government bodies overseeing environmental regulations, certification agencies, and research institutions focusing on sustainable processes and materials.

As a validation of the above required skills, it is worth highlighting that the Campania region is facing challenges related to bioeconomy related education. There is only limited availability of skills and expertise related to the green economy in both public and private sectors, low presence of companies engaged in innovative processes or

product development activities, a significant percentage of young people categorized as NEET (not in education, employment, or training).

3.3 DENMARK

3.3.1 Adult education and lifelong learning opportunities

The internal survey findings show a great variety of master's level programs on bioeconomy related sectors in Denmark. **However, these programs are not necessarily connected to circular bioeconomy, with few exceptions referring to sustainability**. This can be explained as **circular bioeconomy being considered as** a separate topic, and it is not being incorporated into educational program. Again, the vast majority of the programs are provided on-site at a national level while English is also widely provided. (Chapter 5)

Table 3 List of Educational programs related to Circularity and Bioeconomy in Denmark

Academic Programs					
University	Name	Language	Level	Attendance	Link
University of Copenhagen	MSc Agricultural Economics	EN	National	On Campus	KUDK
University of Copenhagen	Food Science and Technology	EN	National	On Campus	KUDK
University of Copenhagen	Environment and Natural Resources Economics	EN	National	On Campus	KUDK
University of Copenhagen	Agriculture, Environment, and Development	EN	National	On Campus	KUDK
University of Copenhagen	Forest and Nature Management	EN	National	On Campus	KUDK
Aarhus University	Agrobiology Master's degree program	EN	National	On Campus	AU
Aalborg University	Sustainable Biotechnology	EN	National	On Campus	AAU
Aalborg University	Biotechnology	EN	National	On Campus	AAU
Aalborg University	Bioengineering	EN	National	On Campus	AAU

Aalborg University	Sustainable Energy Engineering	EN	National	On Campus	AAU
Denmark Technological University	Biotechnology	EN	National	On Campus	DTU
Denmark Technological University	Food Technology	EN	National	On Campus	DTU
Denmark Technological University	Sustainable Energy Systems	EN	National	On Campus	DTU
DALUM Academy of Agriculture Business	Agronomy practical training	EN	National	On Campus	DALUM
Teknologisk Insitut	Microsoft Cloud for sustainability	EN	National	Online	TI
Teknologisk Insitut	ESG Principles and Standards	EN	National	Online	TI

3.3.2 Required regional Bioeconomy skills.

Transitioning to a circular economy is poised to necessitate workers to engage in ongoing training to ensure their skills remain current and adaptable across various occupations. As traditional practices are phased out, circular jobs demand substantially more hands-on experience and on-the-job training compared to conventional "linear" roles. These roles call for two distinct sets of skills: deep expertise, tailored to specific industries, and transversal abilities, which are versatile and applicable across a spectrum of tasks, professions, and sectors[1].

Circularity Gap Report Denmark (Circle Economy fundation, 2023) **is referring to the following skills that were identified as needed for bioeconomy: machine learning and data analytics,** specifically skills in areas such as digitalization, software development

[1] Biosolutions in Denmark (only available in Danish): https://irisgroup.dk/wp-content/uploads/2021/06/Biosolutions-i-Danmark.pdf

Biosolutions and Power-to-X: https://irisgroup.dk/biosolutions-and-power-to-x/

The Plant Biologicals Cluster in Southern Scandinavia: https://irisgroup.dk/wp-content/uploads/2021/10/The-Plant-Biologicals-Cluster-in-Southern-Scandinavia-1.pdf

and data analytics**; project management and stakeholder engagement within the circular economy principles; development and commercialization of alternative protein sources (plant-based proteins, insects, cultured meat).** Also, the following topics were considered as missing: waste management (valorization of waste streams, recycling and upcycling, traceability), production of bio-based products, creation of added value products from biomass, within biotechnology and bioprocessing; and knowledge about regenerative agriculture, precision farming, and agroecology.

The table below is showcasing the necessary skills:

Table 4 Identified skills for the Danish bioeconomy.

Category	Description
Build a circular built environment	Circular design, Circular business models and project management, Life-cycle assessment and circular materials management, Digitalization and building information modelling (BIM), Green building technologies, Facility management and retrofitting, Circular procurement.
Embrace a circular lifestyle	Sustainable and circular product design, Circular retails and service models, Consumer engagement and education, Sustainable fashion and textiles, Sustainable food systems, Digitalization
Rethink transport and mobility	Sustainable transport planning, Electric and alternative fuel vehicles, Vehicle and component design, Shared mobility and Mobility-as-a-Service (MaaS), Intelligent Transformation Systems (ITS), Logistics and supply chain management, Digitalization, Materials and resource management, Circular business models and entrepreneurship
Nurture a circular food system	Sustainable agriculture and farming practices, Integrated food systems and supply chain management, Biorefineries and biomaterials production, Alternative protein sources, Circular business models and entrepreneurship, Digital skills
Advance circular manufacturing	Sustainable and circular product design, Additive manufacturing and digital fabrication, Industrial automation and robotics, Digitalization and Industry 4.0, Circular business models, Industrial symbiosis facilitation

Another important factor, apart from the skills, is localization since experts need to be based close to the outskirts of large cities or urban areas, nearer to where biomass is generated and processed is desired. This is a clear indication of the opportunities offered by bioeconomy for repopulation of rural areas.

As a conclusion regarding the regional needs on bioeconomy training, it looks like technical education to promote circularity and sustainability are in great demand.

Innovation, commercialization, digitalization and cascading use of resources is a priority for Denmark that justifies the trend. The recognition of a need for management and stakeholder engagement needs falls within a more general observation of soft skills being a key aspect of success in bioeconomy endeavors. Therefore, apart from the technical knowledge, soft skills development can also benefit the Danish case.

4. SUMMARY

For a better understanding of how to support the exploitation of BRILIAN results and enhancing bioeconomy education and bioeconomy deployment, BRILIAN pilot countries and regions were scrutinized. The Ebro Valley (Spain), known for agriculture, **contributes through sustainable practices, including agri-food processing and forestry.** In Italian Campania, key players in the bioeconomy span agri-food, forestry, biotechnologies, marine research, pharmaceuticals, and automotive sectors. **These sectors contribute significantly to the region's economy, representing 19.6% of the South of Italy's economy. The increasing numbers in Italy's bioeconomy sector indicate its growing importance. The dynamic bioeconomy setup in Campania presents a promising good example for underutilized lands, especially considering the unmet demand for oils in the EU**. **In Denmark, the bioeconomy is propelled by cascading use methods**, **approach that optimizes side streams' value, broadening product portfolios and promoting sustainability.** The focus on cascade utilization reduces dependency on singular products, attracting new investments and fostering innovation in the biorefining sector. Denmark also embraces "blue" biomass, like fish and seaweed, easing pressure on land resources; these sustainable practices shape Denmark's bioeconomy, **driving innovation and diversifying value chains.**

While the regional bioeconomy profile differs, the status quo about bioeconomy education is very similar. **Circular bioeconomy is rarely integrated in the curricula, there aren't many master's or bachelor's degrees exclusively in bioeconomy; most of them cover only a small part of the bioeconomy sector (such as biotechnology, sustainability) or include one or two courses titled "bioeconomy".** There is a lack of courses or master's programs related to bioeconomy in English. Especially in Spain and Italy, master's studies in national languages show the regional character of education. Only in some cases highly sector specialized training is provided.

The survey results show all three countries require the following skills: technical-scientific knowledge, project management, environmental assessment, communication abilities, knowledge of the green economy, and digital skills such as data analytics. Interdisciplinary approach is required in all activities related to circular bioeconomy production models likewise the need for sustainability and circular economy expertise. It was discovered that training on how to make every day sustainable living decisions and how to consume responsibly is needed for the wider public. Production-wise, this is an important element as it cultivates a market that can opt for sustainable solutions more easily.

Education is crucial in creating a skilled workforce to enhance local circular bioeconomies; **education is understood as a systemic way of achieving local sustainability goals, even when it's not directly referring to bioeconomy**. In Spain, education on sustainability principles is trying to be integrated at all societal levels, including responsible consumption and production. In Italy, the national bioeconomy strategy mentioned cross-disciplinary education and training for researchers and technical careers along with updating educational programs to accommodate interdisciplinarity with the support of private, public and agricultural actors. In Denmark, the Food & BioCluster Denmark is taking up a leading role in educational initiatives under the support of the ministry; this cluster is the Leader of the BBI- JU BIObec Education Centre.

Key skills required across various sectors include sustainable agriculture, renewable energy specialization, regulatory expertise, soft skills like communication and project management, environmental knowledge, technical-scientific skills, economic analysis, digitalization, sustainable transport planning, and circular business models.

Despite the demand for job market-relevant skills, **there's a lack of direct training programs.** Bridging this gap requires an educational initiative to swiftly equip the local workforce with necessary skills, particularly in **vocational training tailored** to bioeconomy. Practical examples from local pilot programs can enhance relatability and highlight the benefits of circular bioeconomy business models.

5. MATERIALS & BEST PRACTICES

This chapter showcases best practices from across EU collected according to the guidelines (please refer to Annex 1). Partners pointed out several interesting videos, on-line platforms, regional programs and also some EU projects focused on bioeconomy education. In this chapter, there's an effort to include libraries, project results, and open access platforms that BRILIAN can use and enrich to produce educational materials. Although the identified platforms do not perfectly fit the training topics suggested by BRILIAN (Chapter 6), the topics have been broadly categorized (in topics rather than in countries/regions) below for easier navigation and use also mentioning the relevance for BRILIAN. The suggested materials will be further researched and will be used according to the emerging needs of the training development.

Material design considerations

Name: Fostering Entrepreneurship for the Bioeconomy
The consortium created a course syllabus that would promote entrepreneurship in the bioeconomy. This model was based on the recommendations of professionals and the teaching of the partners (Intellectual Output - IO n°1). The aim was to implement this model through synchronous and asynchronous learning in order to best develop students' skills. The recruitment of a pedagogical engineer was necessary to achieve this result (IO n°2). Through a survey within the partner institutions, innovative teaching practices in the field of entrepreneurship were collected for the elaboration of a guide (IO n°3). Finally, the consortium gathered feedback and recommendations from students and professors to draw up a report summarizing best practices for promoting entrepreneurship education in the bioeconomy (IO n°4).
Link: FOEBE_Online_training_entrepreneurial_soft_skills.pdf (europa.eu)
Relevance: SPAIN – Guidelines for entrepreneurship training for bioeconomy students at master's and doctoral level

Name: ABBEE (Accelerating the transition towards the Bio-Based Economy via Education)
The overall objective of this Strategic Partnership is to inspire and train a new generation of (bio-based economy) students and help accelerate the transition towards a bio-based economy via education of future professionals. New innovative

educational approaches can inspire students, professionals and entrepreneurs to become more active in the bio-based society. The focus of the Strategic Partnership, ABBEE, is on developing, transferring and implementing innovative practices in the field of bio-based economy and to exchange experiences at a European level.
Link: Long_Summary_ABBEE_2018-2021.pdf (europa.eu)
Relevance: SPAIN – New educational approached for inspiration Students, professionals and entrepreneurs

Name: Biobased and social innovation to European local communities
BIOLOC project is funded by European Commission, and it promotes social innovation and inclusion as enabling factors to accelerate the transition to circular bioeconomy and thus contributes to revitalizing local communities in 12 European regions in Bulgaria, Croatia, the Czech Republic, Germany, Greece, Hungary, Italy, the Netherlands, Romania, Slovakia, Slovenia, and Spain. Through extensive interdisciplinary research and cross-sectoral analyses, BIOLOC will elaborate on concepts and solutions that will trigger positive cascading effects on communities by fostering a participatory and inclusive approach to develop resilient innovative biobased activities open to the contribution of socially disadvantaged or marginalized groups. In this way it will deliver innovative and inclusive business models and drive the establishment of permanent public-private multistakeholder hubs to pioneer a social trialogue on innovative and inclusive circular bioeconomy as a leveraging factor for sustainable and resilient local communities.
Link: Bioloc – Biobased and social innovation to revitalise European local communities
Relevance: Positive example for business models that can enrich the BRILIAN paradigm. Possibility for clustering

Name: BIObec project
BIObec aims to build bridges between the bio-based industry and the education system by interlinking universities, innovation labs, and R&D centres with industrial actors and regions. In order to achieve this, the project proposes a holistic framework that merges the traditional idea of an education centre, with that of a knowledge hub. BIObec will establish the framework for the development of multi-level Bio-Based Education Centres (BBECs) to act as knowledge hubs bridging the gaps between

academic institutions, students, innovation entities and policy makers. Likewise, the BBECs will be flexible enough to answer the actual and future needs of the industry and surrounding ecosystem at local, regional and national levels.
Link : https://biobec.eu/project/
Relevance: Guidelines on how to create an educational center

Name: EU CAP Network Seminar 'Skills and lifelong learning for agricultural advisory and training service providers'
New CAP strategic plans provide several tools through various interventions to foster knowledge exchange and training on innovative approaches for farmers, foresters and advisors; with high potential for increased uptake by and enhanced impact among relevant stakeholders.
Link: https://eu-cap-network.ec.europa.eu/events/eu-cap-network-seminar-skills-and-lifelong-learning-agricultural-advisory-and-training_en
Relevance: Use the guidelines and instructions to create effective materials

Name: BIOeco- UP INTERREG Central
WP2 of the BIOeco-UP project is delivering info sheets about several bioeconomy topics provided in attractive design for wide public to raise awareness about bioeconomy. The info sheets are available in English, Italian, Hungarian, Croatian, Polish and Slovenian.
Link: https://www.interreg-central.eu/projects/bioeco-up/
Relevance: Use as a reference for the design and educational approach to engage a wider public and the local stakeholders.

Name: Incentives and bottlenecks for farmers to adopt NFCs
Based on 288 farmers questionnaires among farmers that cultivate(d) Non-Food Crops (NFCs) and farmers that have never cultivated NFCs, we identified the incentives and bottlenecks for the uptake of Non-Food Crops into the crop rotations of farms in four geographical regions; Mediterranean, Atlantic, Lusitanian and Continental/Boreal. Differences were identified between these regions in the NFCs

cultivated, the purposes of these crops and the market structure. However, the incentives and bottlenecks for NFC uptake are comparable. The mentioned incentives to cultivate NFCs are profitability and demand, while the main bottleneck for the uptake of NFCs is the availability of knowledge and crop advisors. Most farmers that currently cultivate NFCs will continue cultivating them in the future.
Link: Report on farmers' needs and interests
Relevance: Use for the training design and as a conversation starter at trainings to help farmers share their experiences.

Policy alignment

Name: Knowledge Centre for Bioeconomy
The Knowledge Centre for Bioeconomy supports policymaking by identifying, filtering and structuring relevant information and making it accessible, bringing together researchers, policymakers and other experts in the field analyzing, synthesizing available evidence and communicating it in a transparent, tailored and concise manner.
Link: https://knowledge4policy.ec.europa.eu/bioeconomy_en
Relevance: Selected materials and information can be used for trainings related to policy

Name: Open Forum for Transparency and Active Listening between local Entities and the Government of Aragon
Open Forum for Transparency and Active Listening is a collaborative space for the exchange of experiences, communication and dissemination of knowledge and good practices between the Government of Aragon and local authorities on the circular economy, prevention, and management of household waste. Through the creation of the so-called Forum and the virtual support tools (website, distribution list), it has been generated an informal network between the people responsible for waste management in local entities and the Government of Aragon, which contributes to facilitate the daily work in the exercise of their responsibilities, through the exchange of concerns and solutions among all involved agents.

Link: Open Forum for Transparency and Active Listening between local Entities and the Government of Aragon | Interreg Europe - Sharing solutions for better policy
Relevance: SPAIN – Local entities involved, can be used as a good governance example

Training for farmers

Name: Deliverable 4.2 (PANACEA Project) Training for farmers
This module provides an in-depth overview of non-food crops (NFCs) in Europe, covering their agronomy and applications. Split into two sessions, it combines hands-on trials and group discussions to enhance learning. Participants receive extensive support materials, including crop fact sheets, and collaborate to create a comprehensive NFC comparison table. This structured approach equips participants with essential knowledge and skills for navigating the NFC landscape effectively.
Link: https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5ddcac8fe&appId=PPGMS

Name: Deliverable 4.5 Fact sheet with trainings of farmers (PANACEA Project)
The Panacea project has developed targeted training sessions for agronomists, farmers, and students to enhance understanding of non-food crop (NFC) cultivation and valorisation. Key objectives include mastering crop management, exploring valorisation pathways, and understanding economic and environmental considerations. Training emphasizes profitability, environmental sustainability, and regulatory alignment, equipping farmers with essential decision-making tools.
Link: https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5da7faf65&appId=PPGMS

Name: D4.1 Training Materials for Agronomists and Students
With increasing demand for renewable resources and the growing emphasis on bioeconomy development within the Common Agricultural Policy (CAP), crop-based biomass plays a significant role in addressing societal and economic needs. This report, part of the PANACEA project, aims to provide comprehensive training

materials for agronomists and students on non-food crops' current state, markets, and agronomic challenges within the bioeconomy framework.

Part A delves into the current landscape of non-food crops in Europe, drawing from literature reviews, research findings, and PANACEA project deliverables. It covers biobased markets, existing biorefinery types, and offers twenty-four crop-specific agronomy factsheets. Part B fosters interdisciplinary thinking through group exercises, encouraging participants to design non-food crop value chains and develop policies to support their integration. Additionally, tailored national training presentations have been developed in collaboration with project partners, addressing specific crop choices and market opportunities. This training material equips participants with essential knowledge and skills to navigate the evolving landscape of non-food crops within the bioeconomy paradigm.

Link: Training material for the Agronomists and students

Relevance: Selected materials and information can be used for trainings related to the value chains.

Name: Commission supports creation of a partnership for skills in the agri-food ecosystem
Supported by the Commission, the agriculture and food industry present a skills partnership under the EU Pact for Skills today. The goal of the partnership is to upskill and reskill people in the agri-food sector, the largest producing and manufacturing sector in Europe. This will make the agri-food ecosystem more attractive to young people, while offering a lifelong learning perspective for both employers and employees. The partnership signatories include EU associations, companies, organisations, universities and national federations. The ecosystem ranges from family farms and micro and small food processing companies to large multinationals.
Link: https://pact-for-skills.ec.europa.eu/index_en
Relevance: It can be a portal to introduce to local stakeholders

Name: OER network
A Hub that works as a custom resource center for groups to can create and share project or organization-related collections. There institutions, Projects, countries and initiatives network with various educator groups to *"create, organize, and share collections that meet their common goals".*

Link: https://oercommons.org/curated-collections/1374?f.search=agriculture
Relevance: SPAIN – Source for materials regarding agriculture and climate for high-schoolers that can be adapted for our audience

Name: Producing more with less. The Danish transition to a bio-based society with resource-efficient production.
The aim of the white paper is to share some of Denmark's solutions and experiences from our ongoing transition to a sustainable agriculture and food cluster that is based on renewable biological resources and ultra resource-efficient production. We believe that by doing so, we can make a tangible contribution to achieving progress on the global sustainability goals and inspire others to do the same. We have gathered a selection of cases, which provide specific examples of how the agriculture and food cluster in Denmark reuses, recycles, and upcycles residual and by-products to create new forms of food and feed, materials, new products and even energy. The selected cases also include examples of how maximum value can be extracted from resources, thus reducing overproduction and overconsumption. The cases are supplemented with perspectives from a number of actors in Denmark that work to drive progress in this area. This White Paper provides insights and guidance on how sustainable production in the agriculture and food cluster can be achieved, by way of concrete and ready-to-be-implemented Danish technologies and solutions. The examples contained in this publication can be implemented in a number of contexts and are sustainable in all senses of the word – not only economically, but also environmentally.
Link*:* https://stateofgreen.com/en/publications/producing-more-with-less/
Relevance: Think Denmark: White papers for a green transition (July, 2018). PRODUCING MORE WITH LESS: The Danish transition to a bio-based society with resource-efficient production. U. Jørgensen (Ed.). State of Green.

Circularity & Bioeconomy

Name: Circular Design OER Database
This database is an early attempt to collate as many of materials as possible and present them in several, easy-to-navigate categories related to Circular Design and sustainability

Link: Knowledgebase - Circular Design (circulardesigneurope.eu)
Relevance: SPAIN – Some materials can be training sources

Name: PROCOMUN
An online network of open access educational materials focusing on circular economy, environmental education and sustainability for various age groups.
Link: https://procomun.intef.es/en/search-full/economia%20circular
Relevance: SPAIN – Source of materials regarding circular economy for different age groups

Name: NOVAMONT CHANNEL
Videos made by Novamont experts on concepts and topics related to bioeconomy and circular economy
Link: https://www.youtube.com/@NOVAMONTCHANNEL/videos
Relevance: ITALY – Materials about circularity issues addressed to the general public

Name: Federica web learning
Federica's platforms offer over 450 MOOCs entirely open access by some of the outstanding academics of Federico II and other leading Universities. With over 600k enrollees, Federica has the largest Italian academic courseware portfolio worldwide. Almost 100 of Federica courses – academic as well as professional packages – are also offered in English on edX the Harvard & MIT MOOC Platform. Objective of the educational format: university course.
Link: https://www.federica.eu/universita/lauree/industrial-chemistry-circular-bio-economy/
Relevance: Materials about circularity issues addressed to university, Open access

Name: The concept of bioeconomy
"[…] animals, plants, microorganism, insects we call them biological resources […] they are living, and these biological resources have a lot of advantages […] they are renewable, very important today for the efficiency of the limited resources we have on the planet, they have a certain climate neutrality if they are being processed rightly and used rightly, the so called carbon neutrality […] the third one is if you use them in cascade form they can be multiuse and then can be recycled, and the fourth point,

the most important one: these biological resources have particular functions which are better and not to be found in fossils like longer lifetime, stronger endurance, less water they use, certain robustness in their surface, etc. so they offer new functions on new product and material, and all these things together we call bioeconomy […]"
Link: https://www.youtube.com/watch?v=WtTQVS8-KnI
Relevance: Christian Patermann, former director on the EU Commission explains the concept of bioeconomy, for the Circular Bioeconomy Days, hosted by CBIO (Center for Circular Bioeconomy, Aarhus, Denmark).

Name: TKNIKA
"Tknika is a centre promoted by the Deputy Ministry of Vocational Education and Training of the Education Department of the Basque Government. Innovation and applied research are at the core of Tknika in its ongoing efforts to place Basque Vocational Training at the European forefront. Through networking and direct involvement by the Basque Vocational Training teaching staff, the Centre develops innovative projects in the areas of technology, education and management. TKNIKA has been transformed with the creation of new areas, to focus on biosciences and sustainability, including areas such as: agri-food, circular economy, smart green buildings, and biotechnology."
Link: https://tknika.eus/en/advanced-search/
Relevance: SPAIN – Vocational training focus.

Youth training

Name: Dialoghi con la Scienza - Novamont and Circolo dei Lettori ITALY
"Dialoghi con la Scienza" is a review of five events, to reflect on the most urgent scientific issues and their most compelling narratives. The participants engaged in reflections on topics such as the Anthropocene, fake news, circular economy, and innovative thinking.
Link:https://www.youtube.com/playlistlist=PLgoa7VV3sYclYI30M0sFwqbLRYumc0bnx
Relevance: ITALY - The events with scientists and journalists aimed to bridge the gap between science and the general public, with a particular focus on engaging young people.

Name: One Planet school - WWF ITALY
Courses, categorized into four thematic areas, are exclusively devoted to schools and universities, volunteering, educators, and engaged citizens. The courses offered by One Planet School follow a standardized format aimed at imparting foundational knowledge on the respective topics, emphasizing their interconnectedness, identifying associated challenges, presenting potential solutions, and establishing links with the Sustainable Development Goals (SDGs) outlined in the UN Agenda 2030.
Link: https://oneplanetschool.wwf.it/corsi
Relevance: ITALY - One Planet School emerged as a lifelong learning resource, offered free of charge and accessible to all, with the goal of fostering an innovative educational and training framework centered around diverse, cross-cutting, interdisciplinary themes and the active preservation of nature.

Biorefineries

Name: Green biorefining of grassland biomass.
Kristensen, T., Jørgensen, J. R., Kongsted, A. G., De Notaris, C., Nielsen, C., Mortensen, E. Ø., ... & Gylling, M. (2021). Green biorefining of grassland biomass. U. Jørgensen (Ed.). DCA-Nationalt Center for Fødevarer og Jordbrug. Green biomass may be used to produce local protein, substitute other protein sources, and at the same time obtain environmental benefits. Grass or grass-clover crops on arable land can deliver high yields of biomass as well as protein with a good amino acid profile. Grass from unfertilized permanent grassland may represent an opportunity if focus is on the fiber part of the grass. For cover crops to be an attractive supply of biomass, production systems need to be developed with a sufficiently high production to cover harvesting costs. Changing from wheat or maize to grass results in decreased N-leaching and greenhouse gas emissions. With current techniques, 40% of the protein in the green biomass can be recovered in a protein concentrate with protein content around 50% of dry matter, like soybean meal. Higher contents are possible for specialty applications. In addition, a fiber fraction containing 15-18% protein can be produced and used for ruminant feed, bioenergy production or further biorefined into chemical building blocks or used for biomaterials. Experiments have

been performed on several animal species, where soy was replaced without negative effects on animal performance. High contents of unsaturated fat in the protein affect the meat and fat tissue and may be a limiting factor for included green protein. The fiber fraction seems suitable for ruminant feeding replacing other types of silages. The first industrial scale biorefineries on green biomass for feed and bioenergy are now established in Denmark, while more research is needed to evaluate the protein quality for food applications, and in addition a full EFSA approval. There are major uncertainties in the economic assessment of establishing a full-scale biorefinery. Major obstacles are transportation costs and uncertainty in running cost for the biorefinery. The largest prospects are within the organic sector where there is a need for locally sourced, sustainable protein.
Link: https://pure.au.dk/portal/files/231291207/Green_biorefining_of_grassland_biomass_1407_2021rev_EX
Relevance: Can be used as an example of biorefinery uses

Name: The science behind the potentials of green biorefinery
Jørgensen, Uffe (2020). The science behind the potentials of green biorefinery. CBIO-Aarhus University Centre for Circular Bioeconomy. Green biorefineries can disrupt agricultural systems by creating new markets - and ensure better solar radiation use, less nutrient losses, less pesticide use, soil carbon storage, among other benefits.
Link: https://cbio.au.dk/fileadmin/DJF/CBIO/Uffe_Joergensen.pdf
Relevance: Can be used as an example of biorefinery benefit in a simplified version to address local stakeholders

Energy Sustainability

Name: Power-to-X: Technology overview, possibilities, and challenges
Araya, S. S., Cui, X., Li, N., & Liso, V. (2022). Power-to-X: Technology overview, possibilities, and challenges. *Abstract:* This report gives an overview of the different power-to-X (PtX) technologies and their applications, including in the production of fuels, heating, mobility, industry,

and proteins. It explores the opportunities offered by PtX and investigates the existing or potential future challenges that they can face, including the potential CO2 bottleneck and ultra-pure water supply. Deployment of more renewables and increasing electrification will contribute greatly to reducing our dependency on fossil fuels, but PtX is crucial to decarbonize the sectors of the economy that are hard to directly electrify. For this indirect electrification, the electricity source for PtX needs to be excess renewable electricity from existing sources or from dedicated new and additional renewable energy sources, such as energy islands and offshore wind farms. PtX technologies are expected to play an important role in the Danish strategy to achieve emission targets, and since several Danish companies are involved in the core PtX technologies, Denmark could soon become an exporter of PtX solutions, including the export of green hydrogen. With the global market potential for hydrogen, methanol, and ammonia increasing rapidly every year, there is a momentum of expanding market potential for PtX products. However, government incentives and policies to support the green transition are necessary in the early stages of the PtX era, as the cost of PtX products is still relatively high compared to fossil-based alternatives.

For PtX to succeed globally, it is crucial that new PtX plants do not compete with local resources, such as drinking water supply and use of agricultural land, and that they don't cause loss in biodiversity. Point source carbon capture (PSC) of CO2 from industrial processes is attractive due to high concentration of CO2 and the availability of numerous carbon-intensive and hard-to-abate industries. However, for long-term impact on the green transitions, sustainable CO2 sources, such as from direct air capture (DAC) and from biomass-based processes should be favored.

Link: https://vbn.aau.dk/ws/files/514146100/PtX_Report.pdf

Relevance: Can be used as a topic for the "Sustainability of Bioeconomy" since energy is a crucial topic

6. DEVELOPMENT OF THE TRAINING METHODOLOGY: PRACTICAL GUIDELINES

This chapter is delivering methodology and training framework regarding the educational aspects of the BRILIAN project. This section discusses in particular the target audience and delivery of training to meet the requirements. The training shall take place through a series of thematic webinars with the components of the 1-day face-to-face training course aimed to an as wide as possible audience. This also corresponds to the identified gaps (please refer to the summary provided in the 4th chapter). The aim of this chapter is to ensure that training materials are communicated to the wide public and are easily accessible.

Topics

Topics and tutors – the following five key building blocks are described in the DoA:

1) Sustainability of the Bioeconomy**:** Emphasis on circularity, cascading production models, main issues related to circularity, examples from pilots.

2) Combining private and/or public funding instruments: Examples from EU level, national and local schemes. Main priority areas, things that matter for a successful application.

3) The role of governance and stakeholder engagement for an effective Bioeconomy: Examples of government and private sector interactions, clusters and initiatives from the pilots and other regions

4) Policy alignment: toward a coherent and supportive framework

5) Biorefineries as nodes for rural bioeconomy

As each pilot case and region has specific requirements, the above-mentioned building blocks can be modified accordingly. Table 5 shows the pilot activities.

Table 5 Pilot activities

Spanish Pilot	The Spanish Pilot, led by AITIIP Technological Center, alongside Paturpat and Tecnopackaging, uses potato by-products for diverse applications in the packaging, chemical and pharma sectors. A new

	family of plastic products is developed and technically validated, covering the whole food value chain based on building blocks obtained from the secondary bio-based feedstock. The aim is to reduce Chemical Oxygen Demand by 90% as well as recirculate 140,000m^3 of water and generate 450 tonnes of starch (from estimated 10000 tonnes of potatoes) every year.
Italian Pilot	The limited EU domestic output of oil resulted in the import of over 16 million tons of vegetable oil annually for the past three years. So, to reach self-sufficiency, immediate solutions are required. In this regard, the BRILIAN project aims to introduce a novel business model in collaboration with farmers' associations and cooperatives to encourage the cultivation of drought-resistant and low-input crops on marginal and underutilized lands. Led by Novamont, the Italian Pilot aims to revitalize unproductive/marginal and economically unsustainable farmlands by cultivating crops such as cardoon, safflower, and sunflower using regenerative agricultural techniques to produce: a) vegetable oil that can be used to create valuable bio-based products such as bioplastics, biolubricants, biofertilizers, and bioherbicides; b) oil cake, utilized for producing biostimulants and animal feed; c) cardoon biomass, which will be processed into ingredients for producing substrates (bales) essential for cultivating edible mushrooms.
Danish Pilot	The production of rapeseed oil in Denmark generates rapeseed cake residue that is currently used as feed for animals. However, there are still proteins and other valuable components left in the cake that can be extracted for other applications. In the Danish pilot, led by the Danish Technological Institute, one ton of rapeseed cake will be processed, producing up to 100 kg of the final product. The aim is to obtain a final product with at least 50% protein content and low levels of antinutritional factors. This will improve the organoleptic

	properties of the final product and therefore the consumer perception.

Target audience

Local stakeholders from the pilot regions are also part of the target audience and will be invited. ABF (Advisory Board of Farmers) members are expected to participate in the trainings – where applicable due to language limitations – to share their valuable experience from the sector and to encourage more locally involved contacts to participate and raise awareness. The European Network for Rural Development (now EU CAP Network) will be also involved – through BHCZ and its connection with the Czech Ministry of the Agriculture - to spread as much as possible BRILIAN innovations among the rural communities. The respective CBE-JU working group will also be invited and encouraged to participate to align and reach out to more networks.

Timeline

The content of the material will be sourced from the outcomes of the BRILIAN project, especially related business and models and support regulation that will be developed in WP2, WP3 and WP4. To get the most out of BRILIAN's results, the trainings have been aligned with the following deliverables:

- After M24: WP2 Deliverables on Social Innovation and Stakeholder engagement: T2.1, T2.2, T2.3, T2.4
- After M24 and M40: WP3 Deliverables regarding the sustainability of the Bioeconomy: T3.1, T3.2, T3.4
- After M36: WP4 Deliverables regarding the Business models: T4.1, T4.2, T4.3
- After M40: WP3 regarding the policy proposals: T3.3
- After M42: WP4 regarding the optimization Toolkit: T4.4

Given that some of the aforementioned deliverables are of sensitive nature, partners will provide their consent regarding specific information that can be disclosed through the trainings.

The Tutors/ moderators

Moderators for the webinars will be suggested by the partners depending on the expertise to cover and the **local language requirement.**

Training will be provided in the local languages for each pilot, partners will help with translations in local languages from the original materials created in English and also propose speakers based on the topics. For the BIOEAST macro-region, given the diversity the original series will need to be in English with option for subtitles in the 3 local languages based on the replication site proposals developed in WP6 (Task 6.1).

Webinars

- Platform: The webinar platform should be provided by the webinar organizer. In case support is needed, CIRCE will try to provide assistance.
- Interactive tools: Slido, menti, break out rooms are encouraged if it's necessary to increase engagement.
- Training participants will be informed at the beginning of the webinar regarding BRILIANs GDPR policy, the recording and distribution of the materials.

Face 2 Face trainings

To foster active participation at a local level and to facilitate the training process, when applicable, the 1-day "face-2-face" training option can be included for at least 1 of the above training topics. Partners can choose which topic to conduct face-2-face depending on the significance for the pilot and the respective audience. The face-2-face training can also be facilitated in combination with other opportunities like local events and study visits to engage the maximum number of stakeholders.

Invitation Info materials

An invitation will be created along with visual graphics to be showcased both as info sheets about each topic with key takeaways, and as a presentation. The distribution of the invitation will take place both from the BRILIAN communication channels but also from our consortium partners who are engaged with local actors.

Information and communication about the trainings should be tailored for each pilot and in local languages to align with the general tendency identified and to reach the target audience focusing on local farmers and key players of the bio-based value chain.

Emails: An email invitation template will also be created to assist the partners with inviting their local networks, and also to reach out to related projects who are also developing training materials and aim to engage their audiences.

Registration and GDPR

Registration: participants should register before the webinar through Google forms or any other means that the organizers find adequate as long as it allows participants to agree on the collection of their personal information (Name, Surname, Affiliation, Email, etc.). A related template will be provided to all partners in due time.

During their registration (and at the beginning of the training regardless of whether it is a webinar or face-2-face), participants will be informed regarding BRILIANs GDPR policy, the recording and distribution of the materials and photos.

Feedback and follow up

A questionnaire will be issued to request feedback about whether the training covered the audience's expectations and further materials and trainings that they would find useful. A related template will be provided.

Thank you, email & NL, subscription: In order to stay in touch with the target audience and offer them the opportunity to engage in further activities, a thank you email along with the newsletter subscription will be distributed.

Materials

The webinars will be videotaped and showcased on the BRILIAN webpage (with BRILIAN format). The recorded webinars will be shared in social media channels but also in the channels of related projects and platforms to create a common base for training opportunities across EU local stakeholders and reach a wider audience. AI generated subtitles in English for the webinars is also suggested to reach an as wide as possible audience.

In the case of face-2-face trainings, the presentations, videos and other materials used for the training will be published at the BRILIAN website along with the key takeaways and feedback from the discussions with stakeholders (Template for the feedback gathering will be provided).

The materials generated through the training process will be integrated in a user-friendly guidebook.

Cooperations

For a more holistic approach, and also to support project to project cooperation, several international projects developing bioeconomy education activities were identified: RuralBioUp, BioEco-UP, GRANULAR, BIORURAL, BBIONETS, BIOLOC, bio2reg, BOOST4BIOEAST, MAINSTREAMBIO. These projects have been approached to join efforts in delivering training and the possibility of cooperation is under examination. The list of projects may change during the project as more opportunities to cooperate arise.

7. CONCLUSIONS

In this First Report regarding the capacity building and training actions an analysis of the educational status, needs, trends, and bioeconomy education governance was initiated by gathering information through our partners. The results highlight that although all regions stress the importance of bioeconomy education for the advancement of the sector and the overall availability of academic, there are still efforts to be made to meet the bioeconomy education needs. More specifically, there are two main issues to be addressed:

1. Lack of interdisciplinarity: frequently, the academic education provided concerns a specific scientific field. The demand for a high technical background justifies the situation. However, the market needs a broader understanding of the challenges faced by bioeconomy, which require knowledge from different scientific fields along with a wide variety of soft skills.
2. Variety of educational solutions for professionals: Academic studies, though thorough and inclusive, are often unreachable for professionals either because of the cost, or the time requirements. More short-term, targeted VET (Vocational Education Training) options are required that will also be accessible for employers. According to the research conducted by the BIOBec project, employers feel discouraged to provide training to their employees when this interferes with their work life.

BRILIAN, because of the nature of its activities, can provide useful, targeted and openly accessible training materials that will enhance the regional knowledge reservoirs and contribute to inspire local stakeholders towards a more sustainable agricultural direction. An effort to collect and categorize a number of openly accessible knowledge platforms has been described in Chapter 5. However, due to the variety of topics and the different stakeholder groups addressed, few of them will be selected for further valorization for the BRILIAN trainings according to their emerging needs. The knowledge gathered in the first version of this report will be enriched with non-confidential information from related Deliverables across the project lifetime to create the BRILIAN training materials. Furthermore, connections and collaboration with related projects will be pursued to further disseminate the project results and expand the stakeholder base.

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ANNEXES

1. Final Questionnaire Version

Task 7.4 Capacity buildings set-up and implementation

Final Questionnaire

WP7 Dissemination and Communication

ORD			
Version	Name (Partner)	Description of changes	Date
V1	BIOEAST HUB	Draft v1 for project partners	September 2023
V2	BIOEAST HUB	Including partner feedback	18 Oct, 2023
V3			

Task 7.4 Capacity buildings set-up and implementation (M1-48)

This task **aims to develop the training material and methodology** for increasing the knowledge transfer activities to local stakeholders on bioeconomy.

At first the collection and analysis of the already-existing **national and regional knowledge reservoirs** will be provided

BIOEAST HUB CZ prepared this first version of Q that we want to discuss with you in **Sep 2023.** Please provide any comments, questions till Oct 3rd

To all partners: Please fill in the Q until the end of Nov 2023.

A. Questions

Part 1: Value Chains Thematic orientation

- Q1: Are there any significant sub-sectors or value chains within the bioeconomy present in your region? If so, which ones?

- Q2: Have you identified some key trends within the bioeconomy sector in your region? How do they influence the innovations, or the investment in new technologies in your region?
- Q3: can you quantify the value of the bioeconomy sector in your region in terms of total turnover?
- Q4: By 2030, what are the expected key **sub-sectors / value chains** within the bioeconomy in your region?

Part 2: Governance, education levels and skill types

- Q4: Please describe the current governance framework for adult education in relation to the (circular) bioeconomy or the wider theme of sustainability in your region. Please, provide some information, if possible, about:
    - existing policies or strategies regarding (adult) education on (circular) bioeconomy, or on the wider topic of sustainability;
    - What is the role of the national, regional and local institutions and actors on the supervision and management of the sector?

Please include, if possible, links to the English-language resources.

- National level
- Regional level
- Local level
- Online
- On-site
- University students
- Employees
- Other:……

Q7: To your knowledge, has some targeted research (recently) been conducted regarding the most necessary bioeconomy skills in your region? Are there public reports available (any published by statistic departments, universities or research)?

Q8: Please describe the **skills required urgently** in your region, considering its bioeconomy trends, key sub-sectors, and value chains. Are there specific stakeholder groups who request or are interested in these specific skills?

Q9: would the bioeconomy sector be able to develop more quickly, in your view, if your region had a larger labour force available ? Is a skills shortage effectively a person shortage ?

Good examples collection

In line with the Task 7.4. description in the second part of the Q we aim to collect the existing good practices. **We are interested only in the materials that are available in English**. Please try to provide a good practice of materials that can be used for training (i.e., courses, tutorials, videos, web presentations, documents, ppt presentations) on the following topics:

- Circular bioeconomy / bioeconomy business models.
- Combining public and/or private funding instruments.
- Biorefineries.
- Value chains.
- The role of governance and stakeholder engagement for an effective rural bioeconomy.

We need at least 3 case examples from each partner country, and we need the following information about each case example:

- Name.
- Abstract.
- Objective of the educational format (fe. university course / adult training).
- Link.