Engage4BIO

# D2.1

# Mapping results: Potentials, attitudes and boundaries in five bioeconomy hubs

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# Partners short names

| | |
|---|---|
| ZSI | Zentrum Fur Soziale Innovation Gmbh |
| WR | Stichting Wageningen Research |
| APRE | Agenzia per la Promozione della Ricerca Europea |
| BZN | Bay Zoltan Alkalmazott Kutatasi Kozhasznu Nonprofit Kft. |
| EAEA | European Association For The Education Of Adults |
| MOME | Moholy-Nagy Muveszeti Egyetem |
| ArtEZ | Stichting Artez |
| CLIC | Clic Innovation Oy |
| TMG | Business Upper Austria – OÖ Wirtschaftsagentur GmbH |
| MET | Metropolia Ammattikorkeakoulu Oy |
| UNIPA | Universita Degli Studi Di Palermo |

# Content

## Executive Summary

This Engage4BIO report is presenting the results of the Map and Gap analysis, containing the current state, the potential and the directions in the five regional Engage4BIO4BIO bioeconomy hubs: Austria, Finland, Hungary, Italy and The Netherlands. The mapping is based on a canvas methodology (as described in D11), supporting interviews and workshops with small groups of local partners (public institutions, government representatives, industry, art and design representatives, academia and adult education organisations and (in some cases) civil society representatives). The canvasses cover the four perspectives of Engage4BIOs conceptual framework: bioeconomy, regional development, arts and design and learning.

The hubs have gathered the information for the analysis for the various perspectives with a variety of methods. Therefore, the Hubs reports and the executive summaries (as embedded in this report) have different structures, due also to the variety of cultural background, and of maturity level of each Hub in terms of development of the innovation ecosystem.

The results of the Map and Gap analyses provide a number of general insights about the process and about the needs. The mapping process has led to bringing together – in some cases for the first time – relevant stakeholders in the hubs, both from the various bioeconomy value chains and triple helix (governance, academia, industry) partners. This has laid an important foundation for involvement of individuals and organizations in the four co-creation workshops to follow in the project activities; dedicated to the Hub Vision and Strategy, Training guidelines and learning activities, Awareness and Knowledge gain campaign, and Innovative governance models.

In terms of content, it can be observed that the **concept of the bioeconomy** is still unclear or not precisely defined. Most hubs refer to sustainable and circular economy in general terms, but knowledge about and experience with the characteristics of the bioeconomy is lacking, partly due to the limited attention for bioeconomy-related knowledge in both formal and non-formal education.

Most hubs have relevant quantities of feedstock for a bio-based value chain, both from land (crop production, wood), and from the sea (fish). Processing of raw materials into bio-based applications is in some hubs limited. However, this does not apply to the Austrian and Finnish hub.

In Austria, many companies are active in manufacturing furniture, accessories, furniture materials and mattresses, and focus on using predominantly regional raw materials and a short value chain.

In the Finnish hub the paper and board industry is a fully developed bioeconomy sector, presently striving towards more sustainable packaging materials and more circular approaches through a number of innovative developments.

Generally, it can be said that the TRL (Technology Readiness Level) of some of the desired development directions is still very low. In most hubs, there is a lack of human capital and financial resources to get to a higher TRL and proceed to implementation.

In some cases the market for new (bioeconomy) consumer products still needs to be developed

Regarding **the regional development perspective**, it is clear that no hub has a complete and mature ecosystem for bioeconomy value chains. All hubs observe a great fragmentation in their region with limited interactions, both within the value chains and between actors of quadruple helix. There is insufficient interaction between stakeholders in the desired bioeconomy value chains and/or between the various partners from the quadruple helix. All hubs lack a steering organization that connects and allows all actors to cooperate.

The role of **art and design** is related to the two main insights mentioned above.

Most hubs see a promising role for art & design in information and awareness campaigns for public audiences and policy makers about the desire and need for a bioeconomy. Moreover, hubs have sufficient potential with regard to artists, designers and various venues to fulfil this role.

A growing group of independent designers are experimenting with new materials and small-scale production possibilities that can accelerate the transition to a bioeconomy. However, they are not well embedded in the ecosystem to improve, scale up and implement their innovations.

Designers also sometimes take up the role of driving complex transition processes from a holistic, interdisciplinary approach. Using specific creative co-creation and design thinking methods, they develop shared visions, missions and concrete goals in collaboration with relevant stakeholders. A role they increasingly fulfil in so-called field or living labs, often initiated by knowledge institutions for applied research that try to bridge the gap between fundamental knowledge of universities and its application in concrete practical contexts.

For artists and designers to fulfil these roles well, **formal higher education** in particular will have an important responsibility. In the various hubs there is a great potential of higher education that already pays attention to sustainable and circular design and economy. However, specific, targeted attention to the bioeconomy is still lacking, as an integrated and interdisciplinary approach that brings together the necessary knowledge for the bioeconomy from different perspectives (technology, design, business).

**General education and training activities** with specific attention to the bioeconomy are also very limited in all hubs, both for formal and non-formal adult education. There is little offer for education and training activities that create engagement between all relevant stakeholders from the quadruple helix with some non-formal education activities, (for example workshops and lectures), mainly aimed at the broader public while not focusing on the topic specifically. Developing new and more fitted learning activities primarily requires a clearer formulation of competence and learning outcomes for the bioeconomy. Competence mapping is needed to clarify what is already available in that area and which are the gaps to address. In addition, increased creativity and flexibility are required for these activities, to establish new learning

environments that are relevant to all partners in the innovation ecosystem and that can also be funded from various private and public sources. Opportunities are seen in the project to develop also more and problem-driven learning communities and living labs.

# 1 Introduction

## 1.1 Structure of the report on the Map and Gap analysis

This Engage4BIO4BIO report is presenting the results of the Map and Gap analysis, containing the current state, the potential and the directions in the five regional Engage4BIO bioeconomy hubs: Austria, Finland, Hungary, Italy and The Netherlands. The Map and Gap analysis results constitute the starting point for the regional co-creation workshops to co-design new activities to support the uptake of bieconomy.

The results of the analysis for the 5 Engage4BIOio hubs are summarized in Chapter 2 along with the specific approaches, most relevant findings and learning scenario for future activities. Horizontal analyses are then presented in chapter 3 by the four perspectives of the conceptual framework: 3.1 bioeconomy, 3.2 regional development, 3.3 arts and design, 3.4 learning, describing similarities and differences among the hubs and main conclusions from the various perspectives. Finally, in the last chapter, we draw some conclusions from an integrated perspective at project level.

## 1.2 The Map and Gap methodology

The Map and Gap analysis identifies and analyses the potential for regional bioeconomy development and the knowledge and innovation gaps in the regional hubs and it also aims at supporting the hubs in understanding the different concepts and the actors relevant for the transition to bioeconomy at regional level. By this mapping process, hubs have identified what they currently have in terms of value chains, the level of involvement of relevant stakeholders and maturity level of the current value chain, but also what they need for the transition in the nearby future.

The mapping with the canvas methodology (see Annex 1) is a framework to think and act for future development scenarios towards a regional bioeconomy. The Engage4BIO conceptual framework is based on four relevant and complementary perspectives, as mentioned, and. the Map and Gap analysis has been carried out along these four perspectives.

The mapping exercise with stakeholders was carried out with two methods mostly: interviews and workshops. In case of workshops, the Engage4BIO hub leaders invited small groups of local partners (public institutions, government representatives, industry, art and design representatives, academia and adult education organisations and (in some cases) civil society representatives), which, all together, were able to provide a good overview of the current situation in the regional area, from the 4 different perspectives. Within the workshops, participants exchanged, and co-created feedback based on the four canvas templates and their questions and the findings of the mapping were discussed and analysed in order to investigate the needs for the improvement of the hub approaches and performances. Based on these inputs, each Hub drafted a report describing the current situation.

For the gap analysis a comparable canvas with different questions has been developed. Filling in this canvas has led to a broad overview of potential improvements, needed for the full transition towards a circular bioeconomy.

The hubs have gathered the information for filling in the canvases from the various perspectives differently. The Italian Hub university partner has conducted many interviews and has inserted many references to different relevant documents, which can be characterised as a research-driven approach. Within Hub NL, various stakeholders have been interviewed by experts from different knowledge domains. Stakeholders have been invited for the presentation and discussion on the four canvases. In Finland there is a good interplay between the cluster organization, and their members, with the regional knowledge partners. In Austria, a comparable approach has been applied, while the cluster organization has a central position and is delivering the innovation services for the regional members. This cluster organization has conducted the exercise in collaboration with the knowledge partner. Already co-creation techniques have been applied in the workshop. Within Hungary the Engage4BIO team, professionals from the university on arts and design and on the process dimension, have done the exercise and the reporting in collaboration with the Cluster Organization, as the regional strategies do not exist in the centralized governed country.

Their reports – and for that reason the executive summaries from each hub. which are embedded in this report – have different structures, due to the variety in cultural background and the different phases of development of the innovation ecosystem within the regional hubs.

# 2 Map and Gap analysis results per hub

## 2.1 Hub Austria

### 2.1.1 Methodology

This section reports on the results of the interviews conducted with stakeholders in the wood and interior value chain in Austria. The purpose was to map the existing situation and identify the main needs in the value chain for the uptake of bioeconomy practices. It is noted that this is essential to understand opportunities for transfer of practices that allow replication across Europe and support the further development of bioeconomy practices. The interviews involved representatives from the industry, education, regional development, and art and design, and the method used was a one-to-one approach, either in-person or online. The results emphasize that involving different stakeholders was important to gain insights into the key actors in the ecosystem for the transition to bioeconomy and identify needs and boundaries in the region, considering the diversity of regional/local approaches. The interviews provide a solid basis for the future work in the co-creation and development of bioeconomy practices, which will be carried out until 2025 within the Engage4BIO project.

### 2.1.2 Understanding the topic

According to the identified activities and actors in the Map analysis, the regions of Upper Austria, Salzburg, and Styria in Austria have numerous events and fairs promoting sustainability, circular economy, and bioeconomy topics. The events involve experience exchange, project initiation and accompaniment, and cooperation between design and academia. Small, micro, and large enterprises in the wood value chain mainly participate in these events. The events also attract academia and designers. Additionally, educational institutions offer flexible formats and topics in their courses and workshops. These institutions include VHS, WIFI, BFI, LFI, the Association of Austrian Hochschulen, University of Natural Resources and Applied Life Sciences Vienna, and FH Kuchl. The focus of the courses and workshops is on sustainability, and the target groups are adult learners. Although there are no training institutions providing training around bioeconomy specifically, the events and courses around sustainability topics provide opportunities for networking and learning about challenges in society.

### 2.1.3 Resources and regulations

Different types of resources used in the Austrian furniture manufacturing industry were described, including natural resources, capital resources, human resources, and intangible resources. Wood is the primary natural resource used, but due to the lack of strict norms and certifications, it can be difficult to find wood with the same condition. Capital resources are available through various funding sources, including EU-funded projects and the Waldfonds[1]. The human capital in Austria is well-educated, but some stakeholders suggest more interdisciplinary cooperation is necessary. Intangible resources include technology resources, such as CAD-CAM software, 3D design, and CNC (Computerised Numerical Control) machines, which are widely used in the

[1] Der Waldfonds - eine Initiative des Bundesministeriums für Land- und Forstwirtschaft, Regionen und Wasserwirtschaft

furniture industry to increase efficiency and quality. Other technologies, such as ERP (Enterprise Resource Planning) software, drawing programs, smart technologies, and additive manufacturing, are also implemented in the industry.

### 2.1.4 Quadruple helix interplay

The challenges and obstacles faced by the quadruple helix actors in Austria vary. Companies face inflation, logistics, and warehousing issues, shortage of key staff roles, and digital transformation challenges. There is a lack of funding agreement between academia and arts and design, where the latter has low priority in Austria, and funding is directed towards technology. There is also a lack of concrete measures taken to promote sustainability, bio- and circular economy. Regulatory frameworks are not implemented equally across all sectors, and legal procedures are too long. The right mindset for a circular economy way of thought is missing at the political and legal levels.

Additionally, companies seek cooperation and partnerships with other companies, including those from different branches, for specific know-how in other areas. Big companies invest substantially in R&D and see opportunities in digitalization. When it comes to the civil society, then it is interested in learning about sustainability, and there are educational opportunities available around eco-design, bioeconomy and circular economy. The analysis has also shown that the different stakeholders are willing to work together to create an Austrian-wide network for bioeconomy. Many opportunities can emerge from working together. Best practice examples in the region, cluster organizations from different Austrian states, and educational institutions can build cooperation and create synergies. However, the right regulatory measures are needed to motivate companies towards the green transition.

### 2.1.5 Gap analysis – needs

The Gap Analysis identifies the need for increased support for all actors in the quadruple helix (industry/economic, academia/education/universities, government/politic, and civil society) to advance the bioeconomy. Increased funding is recommended for educational institutions and the arts and design sector, which requires more collaboration and cooperation from public organizations and politics. The importance of the media in promoting bioeconomy activities is also highlighted and it is suggested that academia needs to adapt to using more digital channels to reach younger generations. Emphasis is put on the need for increased support from politics to promote a circular and bioeconomy-based mindset and to push industries towards sustainable measures. Additionally, it is suggested that companies need to adapt their business models to a new economy model based on circular economy and bioeconomy and need support from clusters and regional development. The need for increased understanding of the importance of forest management and the entire value chain in the context of bioeconomy is also highlighted. As a result, several opportunities are proposed to promote the implementation of bioeconomy activities, including organizing workshops and lectures, working with local craftspeople and artists to create and sell products made from wood, and integrating wood into urban projects.

### 2.1.6 Learning scenario

The Austrian Hub proposes implementing learning activities to address the lack of awareness about bioeconomy and its importance. The proposed activities should target a mix of age groups, be a mix of digital and print formats, use simplified language, be interactive, use available materials as best-practice examples, be free of cost, and be available to the public. The development of these learning activities will occur with educational institutions such as VHS and proHolz Styria. The next steps involve disseminating information about bioeconomy and Engage4BIO, co-creating learning materials with educational institutions, and working with policy makers to address regional bio-based innovation processes and governance models.

## 2.2 Hub Finland

### 2.2.1 Introduction

The map and gap analysis on sustainable packaging within the Finnish Hub aims at supporting the transition towards circular bioeconomy and shapes the co-creation and development activities. The primary objectives of the analyses are to map the current situation and identify the greater needs for a stronger uptake of sustainable packaging.

The analysis covers the four approaches of the Engage4BIO framework; namely:

- bioeconomy (the technological approach of bioeconomy covering the bio-based value chain, taking into account economic, ecological, and social aspects),
- regional development (activities will be based on the smart specialization of every region and will involve quadruple helix interaction among public, private, knowledge, and societal partners),
- arts and design (bringing in the citizens perspective through art and design from the very beginning using 2D and 3D visualisation and go beyond by approaching domains/networks/facilities with high outreach) as well as
- learning activities (education and learning, skill and capabilities development, and human capital and collaboration).

The Finnish hub on Sustainable Packaging serves as an innovation facilitator and coordinator, as well as a network for learning and knowledge sharing. The hub's primary focus areas are functional bio-based and circular solutions, as well as recycling technologies for retail packaging. Circularity is at the core of the hub's activities, including developing materials with excellent recyclability and creating recycling options.

### 2.2.2 Highlights of the map and gap analysis

Sustainable packaging development in the hub relies mainly on wood-based fibres and bio-based chemicals as feedstock. Both new and recycled fibres are used in the developed packaging solutions. Regarding funding, both public and private funding sources are available for the development work in varying degrees. Specific facilities/infrastructure include research and piloting environments in the universities, research organizations and companies.

A variety of enablers and opportunities, but also obstacles and challenges, drive the development of sustainable packaging. The expectations on packaging and its

sustainability are often conflicting. Acceptance of fibre-based materials, both in general and specifically in packaging, is critical. This pertains to how consumers, brands, retailers, and regulators perceive the role and value of fibre-based and sustainable packaging in the future. Additionally, it is important to establish jointly agreed-upon definitions for key terms. The regulatory environment presents both an opportunity due to its drive towards sustainable packaging, and a challenge, due to its unpredictability.

### 2.2.3 Next steps and future perspectives

A seamless path from ideas to commercial implementation is needed to bring sustainable packaging innovations to market successfully. Achieving this requires expertise in materials and technologies, design, economics, business strategies, commercialisation, and engagement of customers and consumers. An interdisciplinary approach and an in-depth understanding of application areas are needed. Innovation should be driven by business cases that concretise opportunities and impacts, both on the business and society, making the development paths meaningful. New sustainable packaging value chains require the involvement of new actors and increase cross-industry collaboration. To change the old practices and way of thinking, new actors must emerge to challenge the status quo and promote holistic learning across the whole packaging value chain.

The opportunities for design to support the shift to sustainable packaging have not yet been fully exploited and could be better utilised to make sustainable packaging more understandable and meaningful. Sustainable design could support user-driven and co-creative approach in all development, as well holistic system design and customer nudging away from linear to circular models and practices.

Developing learning activities to drive the shift towards sustainable packaging needs collaboration and better resources. Currently, learning opportunities on sustainable packaging are highly fragmented and packaging-specific learning activities are mostly lacking. To fulfil the critical gaps in the areas of consumer awareness, communication and design skills, innovative experimentation, EU regulatory follow up, innovation, and collaboration skills, several learning activities have been identified.

To conclude, we recommend following steps for future development:

- Strengthen the full value chain coverage of the ecosystem all the way from sustainable feedstock to brands and retailers as well as involvement of a more mixed group of companies regarding size (also middle-sized companies) to ensure the successful work of the hub with a real-life impact on packaging.
- Ensure strong motivation of companies, research organisations, higher education institutions, and other partners to commit to the full innovation/development path needed to bring ideas to the real-life, also to more risky innovation.
- Exploit design in making the shift towards sustainable packaging more understandable, meaningful, and desirable as well as to better support

environment-conscious decision-making and supporting understanding on the critical role that packaging has in the society.

- Consider how work and activities on sustainable packaging in Finland is best coordinated across different initiatives (see textile industry for a best practice in Finland). This discussion could also include how the availability and quality of data on sustainable packaging could be strengthened.
- Define a feasible and sustainable funding and operating model for the hub itself.

## 2.3 Hub Hungary

### 2.3.1 Methodology

The map and gap analysis related to the Engage4BIO agro-food hub in Hungary was carried out in early 2023 by the two hub leaders, Bay Zoltan Nonprofit Ltd. for Applied Research (BZN) and Moholy-Nagy University of Art and Design Budapest (MOME). Based on their respective expertise, BZN was responsible for the bioeconomy and regional development sections, while MOME worked on the arts and design and learning activities.

Each partner followed its own methodology, however there were common approaches. For example, the analyses were founded on empirical knowledge and experience of the partners, which was supported by desk research. Results from previous projects in the field of bioeconomy development were also integrated. After each hub member concluded its parts, they collectively discussed the overall outcomes in a hub-level call.

### 2.3.2 Findings

The thorough analysis has made it clear that while there are existing actors, activities and good practices in all the fields examined, the mapping exercise also underlined that the activities are fragmented in most cases, with very little – or even no – coordination, and organised in isolation. This situation is mainly caused by the fact that in Hungary there is no national bioeconomy strategy, government-level strategic thinking and dedicated funds for them. Activities (including educational ones and art and design related ones) are often short-term and project-based.

On the other hand, it was obvious that bioeconomy and related fields have significant potential in the region, as well as in the country. There is knowledge, often available infrastructure, existing practices and active local actors. As for the bioeconomy itself, biomass is available locally. As for the challenges, the lack of dedicated funds and the lack of clarity of legal situation were identified. It was also agreed that the role and importance of SMEs in the region and in the field should be strengthened. Also, the need of new technologies, new value chains and higher value-added products should be recognized. There is a need for technology intensive companies, as they catalyse the value creation.

Examining the rural development aspect showed different key actors, such as the Hungarian Bioeconomy Cluster, the Hungarian Chamber of Agriculture, network of village consultants, network of rural experts, Innovation Operative Groups in the agricultural European Innovation Partnership (EIP AGRI). The connection between bioeconomy and rural development is obvious: bioeconomy sector has significant

impact in the region because it increases TRL of different solutions, involves un-utilised biomass streams in new technologies, supports awareness raising and helps creating jobs. There is a need for the appearance of technology-intensive companies in the region. Additionally, the development of Living Labs or demonstration facilities/ plants would be desirable.

According to the mapping, there are several actors in the art and design field, such as artists, teachers, students, secondary schools, municipalities or museums. The relationship between the actors is fragmented, short-term and sporadic. Existing activities are loosely related or unrelated to bioeconomy. The primary role of art and design could be awareness raising, what is very much needed, as awareness and knowledge of the bioeconomy field is low among citizens. There is a lack of long-term cooperation between the examined areas, as well as of strategic planning and funding. Several strengths were identified, such as the applicable creative potential to non-design areas, as well as the opportunity to translate complex issues for wider audience and policy makers in an approachable and entertaining way and promote good practices and gain them support from public and policy makers.

### 2.3.3 Conclusions

The main overall conclusions from the analysis of learning activities were the low level of awareness and the lack of incentives, which is the primary obstacle and keeps learning opportunities on a very low level. A strategic, stepwise approach, with policy and industry buy-in will be required. We were able to identify only a few bioeconomy-related learning activities. Although the region has considerable bioeconomy potential, this is still underutilised. Good practices that can be adapted need to be identified. In contrary, rural development-related learning activities are well established.

### 2.3.4 Directions

Hub members identified 4 learning activities scenarios. It was agreed that different formats of learning scenarios are suitable to reach other target groups, such as youngsters or specified groups of citizens. The two main target groups of the proposed activities were the students of higher education and primary producers.

There are several opportunities for the Engage4BIO hub in the next years. It needs to expand in both its size and roles. In the bioeconomy related fields, the Hub should have a validation role in strategic development directions in bioeconomy, it should have a role in transferring accelerator-kind of funds. Furthermore, it should increase the number of participating members. Art and design activities should create new bridges between the different stakeholders as they play a very important role in promoting bioeconomy. Art and design can help interpret complex issues in an accessible and entertaining way for a wider audience and policy makers. The Hub should play important roles in educational activities by offering knowledge and practices which may enhance bioeconomy-related activities in different formats of education (including formal and non-formal).

## 2.4 Hub Italy

### 2.4.1 Introduction

The Italian Hub, located in Sicily, is connected with the actors of the regional blue economy system, with a quadruple helix approach. The University of Palermo (UNIPA) is the central research and education partner, working in the blue growth sector and, in the project, collaborates with APRE (Agenzia per la Promozione della Ricerca Europea), that is skilled in management of projects related to bioeconomy. The Hub can benefit from the participation of the associate partners that support some connections with stakeholders belonging to public institutions, education, civil society and enterprises related to primary production and fish processing.

The mapping process was aimed to identify regional stakeholders and their level of involvement and maturity for a regional transition to bioeconomy. The main findings of the map and gap analysis are described in the following paragraphs.

### 2.4.2 Bio-economy

Mapping:

- The companies having potential for the regional transition towards the bioeconomy, belong to Associations of producers from fishery and fish processing.
- Sicily represents the Italian region with the highest concentration of fish processing plants and production of marine by-products, that have the potential to be valorised in circular economy pathways.
- The Italian Hub has developed processes and technologies in support of local enterprises, from pilot to real scale (TRL 6-8), to valorise marine by-products and side streams by producing marine functional foods, value added compounds such as omega-3 enriched fish oils, marine antioxidants and protein hydrolysate's production.

Gap analysis

- The Region needs an innovative production systems, able to coordinate, harmonize and address the use of natural biomass.
- The end-users of the marine value-added ingredients, such as biorefineries, enterprises of the marine biotech sector, are not represented, in accordance with the last national blue bioeconomy report.
- Growth opportunities for companies are still not sufficiently guaranteed.

### 2.4.3 Regional development

Mapping

- The Italian region can boast of a strong public science base and has an excellent framework for bioeconomy implementation.
- Actors involved in the Regional development of the blue bioeconomy belong to private companies, university, research sector and public law bodies.

- The dialogue and cooperation among the different sectors take place thanks to specific projects and programs that are in line with the trajectories of blue bioeconomy, at regional (FEAMP), national (MIUR, PON research and innovation), and international level (Interreg, ITA-TUN, HORIZON, etc.).
- UNIPA is partner of the FORTHEM alliance project that, thanks to the Research, Innovation & Transfer Mission, facilitates cross-institutional and cross-sectoral collaboration of researchers, at all stages of their careers, with local and regional business and economic stakeholders, especially Small and Medium Enterprises, public administration and the policy and cultural sectors.[2]

Gap analysis

- Investment in research and innovation remains below the European average.
- Links between industry and research are still underdeveloped.
- The interaction among regional actors could be improved and needs common guidelines; further investments and policies are also needed.
- Short-term results for the development of the regional bioeconomy sector are linked to the harmonisation of development strategies and the involvement of companies in the decision-making and productive application of the results.

### 2.4.4 Art and design

Mapping

- Italy's first Superintendence of the Sea, established in Sicily in the 2004 operates within the Regional Department of Cultural Heritage and Sicilian Identity and has the tasks of protection, research, census, supervision, of the Sicilian seas cultural and artistic heritage.
- The Italian Hub territory is home to the biggest Italian marine protected areas (Egadi's islands), that support tourisms, recreational activities, festival connected to seafood, music and art exhibition and festival (tuna festival, couscous-fest).
- There is an increasing number of projects on "Creativity, Design, Made in Italy". UNIPA is partner of the FORTHEM alliance project that, thanks to the Art & Aesthetics in Contemporary Society Lab, aims to create new arenas for meaningful exchange through the arts and aesthetic approaches in society.[3]

Gap analysis

- Promotion of art & design activities linked to the bio-based sector is at an early stage.
- Low level of maturity in exploring the relationship between art and design and the bioeconomy in the Hub region.

[2] https://www.forthem-alliance.eu/objectives/research-innovation
[3] https://www.forthemalliance.eu/objectives/labs/art-aesthetics-in-contemporary-society

- Targeted communication strategies, able to intercept curiosity and creativity especially in young people, are needed.

### 2.4.5 Learning

Mapping

- Ongoing adoption of bioeconomy practices in Italian educational and training programs.
- Promotion of specific training courses at local universities in the region.
- UNIPA is partner of the FORTHEM alliance project that, thanks to the Digital Academy links educational offerings at all 9 FORTHEM universities for students of all cycles, development of curricula, flexible international learning pathways[4]
- The Hub hosts the EUROPE DIRECT Trapani Sicilia Center, one of 45 Centers in Italy managed by the European Commission, accessible to citizens to participate in debates, LLL events and activities "dedicated" to the European Union.[5]

Gap analysis

- No updated teaching programmes offered.
- Not efficient communication strategies.

### 2.4.6 Next steps and future perspectives on learning activities

The Italian Hub has proposed three follow-up learning activities, starting with the organization of a Summer school on bio-based products, as an initiative of the University of Palermo, with a location in Trapani. Further Italian Hub is willing to apply co-creation activities on blue bioeconomy by using arts and design tools and techniques. Last learning activity is focusing on training on blue bioeconomy sector at institutional level.

### 2.4.7 Conclusions and next steps

For all the analysed sectors there is the common need to reinforce the collaboration among industry, research and education providers at all levels. The development of new knowledge and the use of new technologies for marine sustainability require the creation of new professional figures with knowledge and skills in blue bioeconomy topic. Although there is a potential for art and design development, the role of artists and creative sector in support bioeconomy, needs to be more highlighted; art related to the sea domain is mostly related to existing natural and cultural heritage resources. Thanks to the opportunity for the Italian hub to work in Engage4BIO, it is possible, as new perspective, to look beyond the current situation and identify a few activities that could support the participation of the civil society and quintuple helix in the territory. New approaches could be explored to put in connection design and creative practices with the Blue Economy, implement and run a pilot study for community open lab on

[4] https://www.forthem-alliance.eu/objectives/european-campus
[5] https://www.europedirecttrapani.eu/

the territory, where artists, researchers and fishery industry representatives could meet citizens and young people to explore together various aspects related to the local Blue economy from social, cultural and science perspective in an integrated manner. This kind of activity would also support awareness raising for new bio-based methods, business models and professionalization (new methods, careers available, educational guidance for courses etc.). Workshops and short courses, such as the one already proposed in the learning scenario, could also be organised within the lab for specific audiences and with more specific purposes (educators, students, industry etc.), while integrated in this common narrative of engagement and co-creation, where the participants have also contributed to the design of such workshops. This approach could also support a more solid base for future participation of young people in the territory development activities.

## 2.5 Hub The Netherlands

### 2.5.1 Methodology

The map and gap analysis on circular textiles aims at supporting the transition towards a circular bioeconomy and supports and shapes the co-creation and development activities of the Dutch Hub. The primary objectives were to map the current situation as well as identify the main needs for better positioning of the hub, and to mobilize and engage partners, to work with the four perspectives of the Engage4BIO approach: (1) bioeconomy, (2) regional development, (3) arts and design, and (4) learning.

Execution of the map and gap analysis has led to involvement of various organizations from different domains of the quadruple helix (public sector, private sector, knowledge domain and society). The Map and Gap analysis included preparing and executing 16 interviews and 1 participatory workshop (10 participants) in March and April 2023.

### 2.5.2 Conclusions

The core of the Dutch hub consists of two knowledge institutes related to bioeconomy (WR) and fashion (ArtEZ), the region Groene Metropool Regio Arnhem/Nijmegen (regional governance on housing, circularity, economy and mobility) and Modepartners025 (network fashion partners). The analysis has made clear that within the region there is attention for the various potentials of sustainable and circular textiles, both focusing on working with virgin bio-based resources, as well as focusing on collecting and valorising textiles waste, which has only recently gained interest at the level of the region. We found potential of specialization and profiling in three directions:

- Fashion and design
- Textiles in interior applications
- Collecting and valorising regional textile waste streams

Bio-based resources for textiles are very scarce in the region, and presently the production, both of textiles for interior applications as well as for fashion, sources raw materials from outside the region. Bio-based textiles are applied, next to fossil-based textiles, but there is limited focus on gearing towards the use of more bio-based textiles.

Circular textiles are within the scope of policies and strategies development, but a clear focus or specialization within the region is missing. There is no clear alignment between policy levels at provincial, regional and local level. The analysis has shown that the circular textiles innovation is in early stages: there are various initiatives and pilots on circular textiles from small companies and from the arts and design sector, but the value chain perspective is missing, and upscaling towards a regional Demonstrator has not yet taken place.

The arts and design sector in the region is much present and dynamic, with a profile on fashion, and with much interest in working with new sustainable materials. Connection with other domains and economic sectors is limited. The outreach towards society can be enlarged.

Also, within the knowledge domain there is interest in textiles. Both the use of bio-based as well as of circular textiles is seen as a promising subject for research and innovation at WUR and ArtEZ as part of the New Ecosystems in Textiles research community. Connection with the regional network and the complete innovation ecosystem in which partners from the quadruple helix are aligned, however, is limited. Higher education (HE) institutes are more aligned with the regional network than the university. ArtEZ is representing the arts and design with a focus on fashion. HAN (Applied University of Arnhem-Nijmegen) is offering regional support towards value creation, but still limited to circular textiles. It is unclear to what extent the academic knowledge is known and applied by companies and governments in the Arnhem/Nijmegen region. In the Eastern Netherlands, there is a stronger connection between developed and applied knowledge for sustainable textile, especially in the field of recycling.

Non-formal learning is on the agenda of the Green Metropolitan Region, with a focus on human capital in the region, but also focussing on meeting each other at events. The Green Metropolitan Region and Stichting Kiemt play an active role in these processes by organizing events and meet-ups. There is attention for bio-based and circular textiles, but with no clear and common focus. Circular and bio-based textiles can easily become more prominent on the regional agenda, when the frames have been set and aligned, and when the support services become more focussed.

### 2.5.3 Challenges

A number of challenges at different levels exist in the Dutch hub.

#### Collaborative visioning and strategic planning

A clear vision of the potential, the future direction and the smart specialization in the region on circular bioeconomy and on textiles is missing. Alignment of strategic policy and planning on regional specializations (fashion and design, interior textile, recycling) and missions are needed on every level (regional, national, international) and within every domain of the triple helix (governance, academia, industry). To encourage sustainable behaviour by consumers and users, it will be necessary to inform citizens about the benefits of a circular bio-based economy.

Prior to the strategic choices, it is important to discover with which valorisation options the region has comparative advantages, what added value activities on circular or bio-based textiles could be stimulated to take place in the region, also in the national and international context.

With respect to fashion and design, the challenge lies mainly in connecting the profile of sustainable fashion in the region more explicitly with (inter)national connections for knowledge development and to arrive at relevant value chains. The sustainable fashion profile should also be better anchored in provincial and regional policies that are now strongly focused on circular economy and energy transition, but do not connect enough to the fashion and textile sector.

**Overcome fragmentation – managing the network and the innovation process**

The fragmentation and a lack of connection between different domains and between potential value chain partners seems to be the main emerging challenge and opportunity in the Hub.

The needs are as following:

- to strengthen the interplay between public and private sector, knowledge and civil society, to set common conditions for innovation and implementation strategies and by making the resources needed available.
- to make connections within the value chain, for example to connect resources (biomass, waste) with processors, designers and constructors of manufacturing equipment.

To overcome these challenges, there is need for an organization which has the network, capacity and organizational power to manage the future development and strengthen the regional innovation ecosystem. It is currently unclear which organization or network is responsible for collecting and bringing together various capacities and means for innovation, or how the responsibilities of the different partners are distributed.

**Attention to (non-formal and informal) learning**

As for learning and education activities, there is an opportunity to strengthen the collaboration and exchange among domains and with awareness raising, and to connect formal learning partners related to bioeconomy and textile/fashion to non-formal and informal learning settings as co-creation workshops, awareness raising activities and living labs. However, the potential for including civil society and any other stakeholders that are not directly involved in sustainability/circular economy could/should be further explored. When the outreach to or the involvement of civil society is improved and enlarged, understanding, support and demand for production of bio-based and circular textiles will grow.

### 2.5.4 Directions and learning scenario's

In the analysis we have found various initiatives and practices, which have the potential to overcome fragmentation, to strengthen the collaborations and to connect the value chains.

- The role of (fashion) designers as pivot in multi-stakeholder cooperation on value chain thinking can be strengthened, by interdisciplinary approaches of research and development initiated by knowledge institutions.
- Some organizations have the position and the capabilities to take a more guiding, steering and funding role to strengthen research and innovation programs within the region. The GIST/Dutch Circular Textile Valley, connected to national and EU-programmes for circular textile, can play a pivotal role to connect knowledge institutions, companies, designers and governments. Existing spearheads of these programs, by governments and universities (of applied sciences), like 'energy transition', 'circular economy' and 'sustainable and circular (fashion) design' can be better aligned.
- There are promising opportunities to create living labs, environments in which collaboration and learning among triple or quadruple helix partners can take place, exploring and testing potential regional solutions. Some are already planned.
- There are opportunities to connect recycled textile resources and residue streams from the agro-food sector to the fashion and design sector for a circular economy. Then, there is a need to strengthen the skills and knowledge of (fashion) designers for social and ecological sustainable design.
- The Green Metropolitan Region (GMR) is supporting circularity, within Nijmegen and with a focus on the triple helix collaboration to avoid waste and to improve the collection and processing of waste. When putting textiles more prominently on the agenda, the GMR can enlarge the outreach towards society, which will be important for the uptake of circular textiles in the region.

This leads to the formulation of three learning scenarios for the region, covering the different identified directions, and which have the most potential for the regional uptake of the circular and bio-based textiles:

- For fashion and design to strengthening and extending the fashion and design profile; This can take place in a collaboration among GIST, Modepartners 025 and the Green Metropolitan Region and his municipalities, with the objective to to professionalize the small initiatives, to involve society and to scale-up initiatives..
- Bio-based interiors to specialize on circular and bio-based valorisation; mobilization of the interior sector, which is quite divers, connect these organizations with the biomass and waste providers. With the help of cluster organizations, knowledge partners and public sector.
- Textile waste to explore the development of value chains out of textile waste. Set up of a waste based value chain on textiles, with the Green Metropolitan Region and waste collectors in the region.

# 3 Horizontal analyses on the four perspectives

## 3.1 Bioeconomy perspective

The five hubs cover a wide range of bioeconomy activities, both on feedstock used as well as on the end applications and markets.

### 3.1.1 Feedstock within the hubs

Starting from the feedstock, both land and marine based feedstocks are covered.

The Hungarian hub focuses mostly on the side streams of crop production. Cereals, vegetables and mushrooms are important feedstock sources, they are produced for food, use of the side streams is developed to a limited extent.

The Italian hub focuses on feedstock originating from (marine) fishery and fish processing. The processors produce food and also side streams which can be applied in various other applications. The valorisation of the side streams is still mostly under development.

Wood is important in the Austrian hub for the production of interior products. Forestry as the producer of feedstock is part of the hub as is obviously the harvest and the primary processing, by sawmills into lumber, timber and plywood. The industry is important, there are approximately 1000 sawmills active in Austria.

Wood is also part of the feedstock for the Finnish hub, but then for the production of paper and board for packaging. The other primary and intermediary feedstocks and products important in Finland are bio-based chemicals and recycled feedstock (paper and board, but also plastics, fossil- and bio-based). The feedstock production is however somewhat less central in the hub as its main focus is on packaging materials and concepts.

The Dutch hub has less connection to the feedstock production. Fibres and textiles used by the hub parties are mostly sourced on international scale. There are some small activities to produce fibre crops for textile production and other products, such as mycelium for the production of leather alternatives. There are also some merging activities towards the use of recycled feedstock.

### 3.1.2 Technologies from the bioeconomy framework

Also concerning processing technologies, the Engage4BIO partners cover a wide area. The chemical industry for the production of bio-based chemicals, bioplastics and plastic processing technologies are important in the Finnish hub, as is the processing of pulp and paper into packaging materials. The Finnish hub is partly based on mature technologies and developing new, sustainable processes to improve the sustainability of their practices.

The Italian hub focusses on biorefinery processing of marine feedstock. The technological activities in the hub are at a relatively low TRL.

The Hungarian hub is mainly focussed on food and feed production; dedicated biorefinery processes to produce high value-added products from side streams are

scarcely present. The technologies that are present have a high TRL: Energy production and the production of bio-based fertilizers are technologies that are applied.

Mechanical processing is important in the Austrian hub: after the wood is processed at sawmills, it can be further processed by the secondary wood processing industry. This industry includes companies that produce products such as wooden furniture, doors, windows, and flooring. Technologies int the hub have a high TRL, but the hub is also developing new more sustainable practices.

In the Dutch hub textile processing into products is important, and done at a mature technology level, but the production of yarns and textiles themselves is mostly done outside the hub.

### 3.1.3 Markets

End markets vary widely. The Finnish hub focuses on packaging products in a broad sense, looking for new more sustainable materials, but also developing more sustainable and circular packaging concepts.

The Austrian hub has interior products as their main focus area, ranging from furniture to interior (and also exterior) building products like doors, flooring etc.

In the Netherlands both fashion design (clothing) and interior textiles such as carpets, upholstery and curtains are developed value chains. These two types of markets are served by a very different set of stakeholders and companies.

In Italy, focus within the hub is on the development of high value ingredients from marine resources, these could also be food additives or non-food products. These markets are still in development.

The Hungarian hub focuses on the development of higher-value non-food applications based on side streams from the food production. Also, these markets are in still in development.

### 3.1.4 Conclusion

The set-up of the hubs' structure and the widely varying focus of the hubs in TRLs, feedstocks used and markets will help the Engage4BIO project to develop activities that are relevant for many players within the bioeconomy field in a wide range of markets, all over Europe.

## 3.2 Regional development perspective

### 3.2.1 Observations

From the perspective of regional development, various relevant underlying concepts have been incorporated within the canvas. Filling in the canvas worked well in receiving a broad picture of the region, but also to discover the gaps and the directions for completing the innovation ecosystem.

It became clear that the partners have different definitions of and approaches within a hub, varying from a region to a subject of research of the current Engage4BIO project. The positions of the Hub partners are different, while some have central position in the region, as they represent the cluster (Austria, Finland and Hungary), others are part of the knowledge domain and are used to observe and analyze the regional development (Italy, the Netherlands). Moreover, the uptake of regional development and smart specialization, and development of circular bioeconomy in different European countries is varying. Finland has a clear focus and regional approach. In Austria, there is a strong cluster approach, but still a very recent national strategy on bioeconomy. In the Netherlands, the smart specialization focus (as defined in the Smart Specialisation RIS3 guide of the EU[6]) is missing, while in Hungary the regional approach is missing, as there is a more central governmental culture. Within Italy there is clear opportunity for regional smart specialization, but the governance of RIS3 is difficult to implement.

### 3.2.2 Smart Specialization

Although all hubs have their main directions, they have in common that they are still searching for the specific valorizations or value-added activity within the regions. Main challenge is to connect the elements of the value chain or to discover the circularity options and to find organizational and business options or models for making it really happen in the region. Often, the connection between the biomass (production and collection) of the primary and the waste sector, and the processing companies are missing. Also, most of the regions are still searching for the specific valorizations and applications, in which they can distinct themselves to other regions, with their comparative advantages.

Hub Austria is focusing on wood-based interiors. The hub is still searching which materials they can optimally make of value. As labor is expensive, the Hub has also the option to focus on concepts, innovations or business services, with their resources as wood, knowledge, business partners and lab facilities.

Hub Finland is focusing on sustainable packaging, which is very broad, because of the different materials (wood or waste), different sectors involved and different potential product lines. Most options are still open, should be explored where the best potential for specializations is to be reached.

Within the Dutch Hub also different options for focusing or specializing do still exist: fashion, interiors, valorization of textiles waste. It is also to be expected that there will not be a large production volume, as there are limited biomass resources available.

[6] https://s3platform.jrc.ec.europa.eu/ris3-guide

Added value may be found in the concept development, and in knowledge innovation and business services.

Hub Hungary is aiming for innovation in agriculture, to enhance the production of alternative protein sources and/or to valorize residual plant-based materials. There are still different options, no regional focus has been set yet.

Within Hub Italy, the region (Sicily) and the sector (marine) are clear, but directions of innovation and applications are not defined yet.

All Hubs are still searching for the bioeconomy-related smart specialization and business models, and have no clear focus in applications. Extending the network with new partners or sectors, completing the whole value chain will be important. Also analyzing the comparative advantages and searching for the regional niche for valorization and new applications should collaboratively take place.

### 3.2.3 Resources

The canvases made clear that resources for the regional innovation and smart specialization process are not fully available or underutilized.

All regions face the problem of lack of funding for the whole innovation process. Most funding is focusing on supporting pilots, but funding for the follow up phases of exploration, testing and demonstration, are limited available. There is a fragmentation in the availability of subsidies, and it is difficult to obtain financial support.

All regions face the problem of the availability of human resources. Capacities are limited and attracting talent is difficult. Connection with educational institutes should be strengthened. Also strengthening the regional circular bioeconomy profile will help to retain and attract human capital.

Within the Hubs, knowledge partners are connected to the partner network on circular bioeconomy or to the innovation ecosystem. But regions also show limited interplay of knowledge partners with the regional network partners as public partners or the value chain partners, on the processes of innovation and valorization of their knowledge. It seems difficult for universities to contribute to the regional practice, as they are stimulated to deliver publications. For the applied educational and research centers there are less barriers to collaborate with the regional network, but there are still barriers, mostly from perspective of their educational programs, which need to be better aligned with the regional strategies, in order to educate the next generation of professionals.

### 3.2.4 Phase of development

The regional Hubs are in different phase of their development, following the phases set by the TRLs, which normally starts with ideation and pilots in which exploration of innovations is taking place, within an interplay among researchers and R&D departments of companies. After this phase, innovations need to be tested and demonstrated to potential users. The last phase is the phase of implementation and business development, also the upscaling of the innovation. From the Engage4BIO Hubs, Austria seems to be a frontrunner as they are in phase of demonstration of their

potential on bio-based interior innovations. Finland is in the phase between pilots and demonstrator, exploring actively different materials and applications, for different sectors, within a network of partners from knowledge domain ad business sectors. The other hubs are mainly still in exploration phase, exploring the different potentials of their region. In Hungary, early ideas and initiatives are originating. In Italy, there is growing focus on the blue bioeconomy, with potentially new non-food valorization options. In the Dutch Hub, there are small pilots of development of bio-based materials for use in textile sector. Also, collection and valorization of textile waste is starting.

### 3.2.5 Coordination and management

The regional development, smart specialization and innovations demands organization and management, for the collaboration and interplay between the quadruple helix partners, for managing the initiatives through the different phases of innovation, for setting the right conditions for regional innovation, and for making the various resources needed available. Within the European Union's regional development approaches, clusters are an important organizational structure for implementing the regional development strategies. Recently also new organizational forms or environments have been introduced as living labs, lighthouses and deep demonstrators. The Engage4BIO hubs all have their intermediate organizations as clusters. Within Austria and Finland, there are active clusters with clear objectives on the smart specializations of interior (AT) and circular packaging (FI). Also, the Hungarian hub has a cluster in which all domains are connected, but dynamics and implementations within the region are difficult, because regional governments or legal organizations at regional level are not part of the governmental structure. Within Italy, there are associations of companies representing the interest of the private sector, but there is no active coordination and management of the implementation process. Within The Netherlands, regional governments have objectives on regional circularity and various intermediates are present, but the specific focus on managing the circular textile development is missing.

### 3.2.6 Recommendations

In the Hubs, we have noticed that the organization of the innovation ecosystem on circular bioeconomy smart specializations is difficult. Often partners are missing and the interplay between domains is sub-optimal, due to limited alignment, commitment, and cooperation.

The results of this analysis make clear that a holistic approach is needed, as well with attention for the quadruple helix and value chain partnership and interplay, within the different phases of the regional innovation and specialization (ideation, exploration, testing and demonstration and implementation), as well to collect and utilize optimally the resources (human capital, finance knowledge, biomass, creativity). Further alignment of the strategies within the different domains and engaged organizations and actors is important. Organizing a holistic approach, however, is difficult, as this is not being organized from one specific domain. Cluster organizations or other intermediates can play an important role in connecting, engaging and aligning partners from different domains and sectors, and in using the needed resources in an optimal way. To manage the regional circular and bioeconomy innovation ecosystem, clusters need to extend from private sector service organization towards a quadruple

helix service organization, with optimal alignment with regional partners from all domains.

## 3.3 Arts and Design perspective

### 3.3.1 General observations from the art and design perspective

The Engage4BIO canvas for art and design identify four potential roles for artists and designers in the transition to a regional bioeconomy:

- Best practices of artists and designers related to the bioeconomy (related to vision development, imagining preferred futures, creating awareness);
- Understanding complex (scientific) data and systems (related to co-creation in complex systems with different stakeholders, creating understanding and awareness);
- Awareness campaigns and interventions by art and design events (related to creating awaress during public events);
- Multi-stakeholder collaboration by art and design methods (related to participation of and co-creating with stakeholders).

These roles can be played from different positions, namely:

- Designers who are part of existing or developing bioeconomy value chains for the various products and services provided by the hubs (textiles/fashion, packaging, food, furniture and interiors). These designers may be employed by manufacturing companies within the value chain, or they may work as SME's independently or within a design studio for clients within the concerning value chain.
- Designers and artists who are not (yet) part of these value chains, but whose work relates thematically to sustainable, circular and/or bio-based design. Independent of the existing chains, they develop new products and services that are often still experimental and small-scale. Their technological and economic growth potential is still unclear.
- Designers and artists who are not part of the aforementioned chains, but are specialized in co-design and co-creation methods for complex ad systemic transition issues. They use specific art and design methodologies to arrive at shared visions, missions and concrete goals for systemic change in collaboration with a diverse group of stakeholders from the value chain or the broader ecosystem (quadruple helix).
- Designers and artist who are participating in design-driven research projects at universities (of applied sciences). Designers and researchers from different knowledge domains do research on relevant topics for a bio-based economy, mostly in collaboration with academia and partners from the field. Beside fundamental lab-research, most design-researchers work in experimental, practice-based research and innovation environments (living labs, field labs, etc.).

What insoghts do the Map and Gap analyses give, based on the abovementioned roles and positions?

### 3.3.2 Designers part of the value chain

In the hubs, the role of designers as part of the value chains is very limited. Opportunities are seen mainly to link designers to user-driven approaches to inform consumers about, make them aware of and seduce them to make tangible,

sustainable, bio-based choices. For this role, designers themselves should have sufficient knowledge of sustainable, circular and bio-based design. The knowledge institutions in the various hubs can make a greater contribution to support this role by extend their educational design programmes for a bio-based economy. In additon, this role of designers is hardly recognized and financial support is limited, often project-related and short-term. Especially the Dutch and Finnish knowledge partners offer opportunities here, on the one hand by innovating their courses on this theme, or to better connect the already existing courses that already have the desired knowledge with the regional ecosystem for the bioeconomy.

### 3.3.3 Designers and artists outside the value chains

Various hubs have designers and artists who are working and experimenting in the field of sustainable, circular and bio-based design. However, they are hardly part of the existing or required ecosystem for bio-based products. It appears to be particularly difficult to make a connection between producers and designers, despite both wanting to contribute to the transition to a bioeconomy. Causes for this are not made very explicit in the analyses. It appears they operate in different networks and there is a difference in their ambitions. Designers and artists can come up with new solutions independent of an existing production system and markets that may be relevant for the longer term. Producing companies will be quicker to look for innovations that fit their existing production and markets, and they want to achieve financial results in the relatively short term. For these companies, collaboration mean a risky and uncertain investment. At the opposite, the designer will feel he has to make too many compromises for an existing market. So most of the opportunities in the hubs are seen in what artists and designers can do to change that market of consumers and users.

### 3.3.4 Art and design for awareness and understanding

Most hubs see an important role for artists and designers to inform and entice the general public as (future) buyers and users of bio-based products  about sustainable behaviour with the aim of increasing sustainable demand. Policymakers are also seen as an important target group to make the opportunities for a bioeconomy transparent for the near farer future. This is largely an educational task involving specific expertise of artists and designers such as creative and accessible, visible and tangible forms of information and knowledge related to the bioeconomy. Most hubs have both the people (artists, designers) and facilities (museums, galleries, fairs, fetivals, etc.) to play this role. A possible drawback of focusing on this role is that design is not sufficiently connected to the bioeconomy value chains in the hubs.

### 3.3.5 Designers as multi-stakeholder connectors

That danger is much less if designers can play a role as systemic co-designers in design-driven innovation processes where they act as pivots within major social traditions. They are not so much designers of products or services, but they act as directors and connectors between the various stakeholders for a common goal to be achieved. Most hubs find that a holistic, interdisciplinary and cross-industrial approach is needed, because the ecosystem is fragmented and there is insufficient steering power to get all actors in the desired direction. In the quadruple helix, academia is responsible for knowledge development, industry has the potential to valorize this as applied knowledge, policy is responsible for the frameworks of laws and regulations

and has decision-making power, and citizens must be able to make responsible choices when purchasing and using goods. At the very least, design can provide insight into the complexity of these different responsibilities and interests by bringing relevant stakeholders together and mapping out their ambitions, motivations and (im)possibilities, on the basis of which joint scenarios can be developed for a future bioeconomy. This does require recognition of this role by design education (which must pay more attention to this), governments (which must support this role financially), industry and citizens (willing to participate in an ecosystem in which common interests must be coordinated).

Especially in the design-driven research projects at universities (of applied sciences), this role seems to be gaining ground as living (field) labs and other forms of experimental innovation environments in which stakeholders from the quadruple helix collaborate.

### 3.3.6 Recommendations

Based on the insights gained from the Map and Gap analyses, we recommend developing concrete activities in which art and design can play their role.

- In collaboration with artists and designers who have knowledge of sustainable, circular and bio-based design, initiate public events with an educational and informative character that provide insights into the desirability of a bioeconomy in an accessible way. In doing so, ensure adequate public funding and be creative with offline and online media to reach as large and diverse an audience as possible.
- Initiate experimental research environments in which stakeholders from the quadruple helix explore the possibilities for a regional bioeconomy for a longer period of time and in which knowledge (academia) is applied in concrete situations (industry) related to the wishes and interests of companies and citizens. In doing so, explore the desired and necessary financial and facilitative support from governments. Deploy designers who are familiar with systemic co-design to design and implement these research environments.

## 3.4 Learning perspective

### 3.4.1 Mapping of existing learning activities

Within the analysis and mapping of learning and training activities, we can observe that there is a diverse approach to define the core learning topics and related competences across the five contexts. The main topics of the existing education activities may be defined or understood in different ways and referred to with different terms (bioeconomy, circular economy, sustainability, climate change, green skills/competences etc.) while, on reverse, learning activities categorized under different topics may have similar content and learning outcomes. In any case, it appears that there is a low level of learning and training activities specifically dedicated to bioeconomy, across all the Hubs.

In terms of type of learning activities, the current landscape appears quite diverse with a variety of education activities in higher education (formal education) and for adults available. In some cases, the educational offer is focused on the specific topics and competences relevant for the Hubs technology, while in some other the offer covers only part of the competences required for the full uptake of the Hub's practices or it addresses mostly one or a few specific target groups and actors of the value chain.

In the Austrian region, education activities are available for professionals and perspectives professionals in bioeconomy, green and eco-design (for example for designers, academia/design students, manufacturers), at higher education level. Activities for citizens at large are flexible, while mostly of a more traditional nature offered by a single non-formal education provider, with some level of collaboration with other stakeholders and focusing on sustainability in general. It appears that there are not specific education activities on the wood value chain.

In Finland, existing opportunities seems to concentrate at formal education level, while learning opportunities on sustainable packaging are highly fragmented and there is lack of learning activities on packaging and of lifelong learning opportunities in general.

The Hungarian Hub analysis seems to identify a general fragmentation and/or lack of relevant education activities, on one hand, also due to low level of awareness and incentives, with many being of short and project-based nature. On the other hand, very specific needs are emerging, such as the introduction of bioeconomy in secondary schools and courses for extension professional on farming methods. Finally, the Hub is identified as playing an important role offering knowledge and practices to enhance bioeconomy-related activities in formal and non-formal education.

In Italy, the mapped activities and the education providers involved seem to focus on formal education, with several degrees in topics related to bioeconomy and green topics (for example, engineering for marine technologies viticulture and enology and Mediterranean agronomic systems). The main actors in the ecosystem for the transition to bioeconomy in terms of educational programs are identified in schools, educational institutions and universities. The needs identified also focus on the formal education system, for example with reinforcing master's degrees, creation of more

research labs of excellence, continuous professional development of professors and teachers and more activities for secondary school students.

As for the Dutch Hub, while the technological perspective (bioeconomy) is missing from knowledge and education activities in the region, more activities are available within the wider region East Netherlands. It also appears that there is potential for opportunities at Higher Education level, with universities acting as knowledge and research hubs, with a focus on circular textile, fashion and design. In this context, two existing practices stand out as opportunities to look at and leverage for designing future education activities: living labs involving SMEs and municipality-led outreach activities strongly connected with arts and design practices.

Finally, availably and sources of incentives and sustainable forms of funding for specific education activities focusing on bioeconomy and on the Hub main value chain is quite diverse and seems also a common challenge, in the perspective of lifelong learning, for example in terms of alignment of the scope of the available funding scheme with emerging needs of the bioeconomy sectors. In some Hubs, for example in Austria, the existence of a bioeconomy strategy support also the funding scheme.

### 3.4.2 Gap analysis results and learning scenarios

As for the results of the gap analysis and the preliminary learning scenario proposed (part of the Learning perspective gap analysis exercise), except for the Dutch Hub, we can observe, a focus on relatively traditional learning approaches. The proposals seem to focus,, for example, on short courses for adults addressing a single target group, both within Higher education and non-formal education, with a relatively low level of co-engagement of the quadruple helix stakeholders in the same learning activity, both as learners and as providers.

In Austria, preliminary ideas for new learning activities focus on workshops and lectures to inform citizens about the wood value chain and to create awareness, to be developed by the main training providers in the region.

In the Finnish Hub, the scope of the proposed activities is more holistic and transversal (consumer awareness, innovation, turning ideas into practice etc.) and most activities proposed are involving multiple stakeholders as providers, while only one of the proposed activities aims at engaging various actors together as learners (citizens, companies etc.).

The Hungarian hub's potential learning scenario focuses on formal education and on the primary needs identified in terms of competence gaps, for very well-defined targets (HE students, producers, extension professionals), with one of the activities proposed expanding the learning approach as well the potential groups involved (a bioeconomy hackathon).

In Italy, the focus seems to be in improving learning activities related to bioeconomy within formal education and institutional contexts, while the topics and purposes of the learning activities would also include art and design aspects and awareness raising elements. The proposed learning scenario favour a model of activity delivered by the

main training provider of the Hub and addressing one specific learner's group for each activity.

Finally, as mentioned, the Dutch Hub seems instead to look already toward broader learning activities, which configure themselves more as regional development knowledge sharing and co-creation labs rather than more traditional training models, involving multiple stakeholders as actors and learners.

Furthermore, boundaries between concrete actions to implement learning and awareness raising activities may be subtle and flexible, from the implementation and impact point of view, and both type of actions can embed characteristics of the other. In fact, in all the Hubs, we can observe the need to keep engaging the quadruple helix in a continuous collaboration approach and to keep translating and brokering the complex aspects of bioeconomy technologies and practices to all actors involved, even though with differences in the maturity level of the context.

### 3.4.3 Recommendations

A few recommendations emerge from the analysis of the learning perspective across the five Hubs.

**Learning contents and competences** - It is important to define the specific learning outcomes and competences for each new activity to be co-created and implemented, beyond the nomenclature applied for the topics. In this regard, it is also suggested that a more detailed competences mapping is carried out, as additional exercise to bridge between the results of the gap analysis and the phase of designing more specific learning activities.

**Business models for education activities and learning approaches** – There are opportunities to expand the existing collaborations (among HE, industry, local authorities etc.) at regional level in the sector also to co-designing education activities, integrating more artistic and creative practices. This approach could have the potential to support a more diverse and sustainable business model for funding the education activities, for example with small sponsorships from local industry, professionals volunteering as trainers, study visits to local activities, free tickets to main events (design fairs etc.), traineeship agreements etc. Furthermore, this approach could also support activities focusing on more experiential learning approaches, such as project-based and challenge-based learning. An example of such direction could be the creation of small-scale pilots of open community labs and living labs, involving together various types of education organisations with local industry, artists and citizens. Depending on the maturity level of the Hub, also lighter and more flexible formats focusing on awareness and knowledge and practices sharing can be developed (for example hackathons, fairs, labs, open days, study visits), also embedding aspects of professional and vocational guidance (opportunities for educational and professional development, entrepreneurial mindset, business development and funding). These shorter and lighter activities can be still integrated in the broader and common narrative of engagement and co-creation, where the participants have also contributed to the design of the education activities to a certain extent. A light

twinning approach could be also beneficial on the development of the main approach, among Engage4BIO Hubs or with other regions with similar bioeconomy focus.

**Synergies within actions and holistic perspective** – It is fundamental to design the learning activities considering the potential links and even integration with the other actions to be implemented within the Hub related to knowledge gain, awareness raising and innovative governance practices. Actions mixing learning and awareness raising activities and elements could be encouraged. This holistic approach to implementation can be extended even further to develop activities that includes learning, awareness raising and design/business-oriented creative practices in one programme. Furthermore, Hubs could also now co-design more long-term and broader initiatives, whose concrete actions are then partially implemented within Engage4BIO life span and continue after.

Finally, based on these considerations, also the concept for **the co-creation process on training and mentoring guidelines and the resulting output** (*T2.3 Co-creation of guidelines for training and mentoring for adults including skills development*) should allow wide flexibility in terms of activities type and design. The co-creation process related to learning activities should support the identification of a more holistic perspective of the whole set of actions to be implemented by the Hubs within the project activities. The process should support the identification of the following aspects: specific needs addressed in context; learners' persona; links with (bio-based) Hub technology and regional development strategies; synergies with other Hub activities (within Engage4BIO or pre-existing); collaboration and synergies with other stakeholders (also not involved in the Hub or sector at regional level); and, finally, also creative practices and innovative elements to be embedded.

# 4 Conclusions

The process and results of the Map and Gap analyses provide a number of general insights. The process of mapping has led to bring together – in some cases for the first time – relevant stakeholders in the hubs, both from the various bioeconomy value chains and triple helix partners. This have laid an important foundation for involvement of individuals and organizations in the four co-creation workshops to follow for Vision and Strategy, Training guidelines, Knowledge gain campaign, and Innovative governance models.

## 4.1 Bioeconomy: a difficult concept

In terms of content, it can be observed that the concept of bioeconomy is still unclear in many hubs. The concepts of a sustainable, circular and bio-based economy are interpreted and applied differently. Most hubs relate to a sustainable and circular economy in general terms, but knowledge about and experience with the characteristics of the bioeconomy is lacking. This is partly due to the limited attention for bioeconomy knowledge in both formal and non-formal education.

## 4.2 Transition to a bioeconomy in a premature state

Most hubs have relevant quantities of feedstock for a bio-based value chain from land (crop production, wood) or from the sea (fish). In addition, in some hubs man-made feedstocks are available like bioplastics, recycled paper or textiles. The Dutch hub is an exception because the main raw materials for textiles are sourced from abroad. The processing of raw materials into bio-based applications is in some hubs limited. Moreover, the Technological Readiness Levels (TRLs) of some of the desired development directions are still very low. This, however does not apply to the Austrian hub where a large number of companies is active in manufacturing furniture, accessories/ furnishing, furniture materials and mattresses, and focus on using predominantly regional raw materials and a short value chain. Also, in the Finnish hub the paper and board industry is a fully developed bioeconomy sector. Presently it strives towards more sustainable packaging materials and more circular approaches, where TRL still needs to increase. There is a shortage of human capital and financial resources to get to higher TRLs and proceed to implementation. Most financial support goes to temporary pilots but subsequent innovation phases are not supported. Hubs are at different stages of innovation. However, for most hubs, the markets for bio-based applications have yet to be developed. In some cases, the necessary technology is present but does not contribute sufficiently to a full sustainable value chain.

## 4.3 Fragmented ecosystem

Regarding regional development, it is clear that no hub has a complete and mature ecosystem for bioeconomy value chains. All hubs observe a great fragmentation in their region with limited interactions, both within the value chains and between actors of the triple and quadruple helix. The hub concept is also not unambiguous and the partners in the Engage4BIO project play very different roles in it. A dichotomy can be seen in hubs that have a clear central steering of an intermediary organization (Finland, Hungary, Austria), and hubs that are mainly supported by knowledge institutions (the Netherlands, Italy). The regional strategic approach differs per hub and can be focused

on the region (Finland) or on a cluster (Austria). The Dutch hub lacks a strategic focus on a specialization and Hungary is entirely dependent on national policies.

All hubs experience high fragmentation in their region to achieve the desired innovations for the bioeconomy. There is insufficient interaction between stakeholders in the desired bioeconomy value chains and/or between the various partners from the quadruple helix. All hubs lack a steering organization that sufficiently connects and allows all actors to cooperate. Most intermediary, regional and cluster organizations that should fulfil this role, mainly support the private sector, while their task should be more broadly focused on connecting actors from the quadruple helix.

## 4.4 Role of art and design

The role of art & design is related to the abovementioned two main insights from the Map and Gap analysis:

- Little knowledge and understanding of what a bioeconomy is and why it is desirable for a sustainable society;
- A fragmented bioeconomy ecosystem in which mutual understanding and better cooperation between stakeholders needs to be stimulated and better coordinated.

Most hubs see a promising role for art & design in information and awareness campaigns for public audiences and policy maker about the desire and need for a bioeconomy. It is precisely their skills to make complex systems and topics visually accessible and tangible that plays an important role here. The hubs have sufficient potential with regard to artists, designers and various venues (museums, design weeks, fairs, art events, etc.), to fulfil this role.

However, this does not yet connect designers sufficiently to the value chains and ecosystem for a bioeconomy. A growing group of independent designers are experimenting with new materials and small-scale production possibilities that can accelerate the transition to a bioeconomy. However, they are not well embedded in the ecosystem to improve, scale up and implement their innovations.

Designers also sometimes take up the role of driving complex transition processes from a holistic, interdisciplinary approach. Using specific creative co-creation and design thinking methods, they develop shared visions, missions and concrete goals in collaboration with relevant stakeholders. A role they increasingly fulfil in so-called field or living labs, often initiated by knowledge institutions for applied research that try to bridge the gap between fundamental knowledge of universities and its application in concrete practical contexts.

## 4.5 Interdisciplinary and challenge-driven learning communities

Artists and designers have the capabilities and the tools to stimulate informal learning in the hubs. In the various hubs there is a great potential of higher education that already pays attention to sustainable and circular design and economy. However, specific attention to the bioeconomy is still lacking, as is an integrated and interdisciplinary approach that brings together the necessary knowledge for the bioeconomy from different perspectives (technology, design, business).

Education and training activities with specific attention to the bioeconomy are anyway very limited in all hubs, both for formal higher and adult education. Most offerings have a traditional character and focus on a specific theme for a specific target group. There is little offer for education and training activities that create engagement between all relevant stakeholders from the quadruple helix. In the area of non-formal education, however, various workshops and lectures are held, mainly aimed at the broader public. The learning activities primarily require a clear formulation of desired competencies and learning outcomes for the bioeconomy. This will clarify what is already happening in that area and where the biggest gaps are. In addition, creativity and flexibility are required to arrive at new learning environments that are relevant to all partners in the innovation ecosystem and that can also be funded from various private and public sources. Opportunities are seen in project- and problem-driven learning communities and living labs.

# Annex 1: Canvases for map analysis

## Bioeconomy

<table>
<tr>
<td rowspan="2">Actors<br><br>How many and which companies are involved?<br><br>Are these SMEs/large companies/mixed? What is the share between large companies/SMEs?<br><br>What different sectors are involved?<br><br>Who are the Value Chain partners?<br><br>How are the companies organised? Do the companies have other industry platforms / associations / federations representing and influencing their joint goals?</td>
<td>Technology and activities<br><br>What kind of technologies are applied in your hub?<br><br>What is the TRL level of the activities in your hub?</td>
<td rowspan="2">Value proposition and products<br><br>What kind of (consumer) products are produced in your hub?<br><br>Where would you position your hub in the bioeconomy graph?<br><br>Do you have circular activities in your hub?</td>
<td>Customers and citizens<br><br>What kind of customers does your hub produce for? (businesses or consumers?)<br><br>Are these customers locally/nationally/ internationally located?<br><br>What kind of citizens are involved in your hub activities?</td>
<td rowspan="2">External influences<br><br>What kind of external influences will impact your near and more distant future? (EU policy, EPR, market forces, etc)</td>
</tr>
<tr>
<td>Resources and feedstock<br><br>What are the main (material) resources for the production in your hub?<br><br>Are they sourced locally/nationally/internationally?<br><br>Are they new or recycled or otherwise?<br><br>What kind of side streams do you have and how do you handle them?<br><br>How do circular activities provide value and to whom, in your hub?</td>
<td>Channels<br><br>Are your hub activities in general visible to citizens?<br><br>Does your hub advertise locally? How do companies sell the products?</td>
</tr>
<tr>
<td colspan="3">Threats<br><br>What are the main threats you see in the (further) transition towards a circular bioeconomy?<br><br>What are the main threats that could impact the viability of your hub?</td>
<td colspan="3">Opportunities<br><br>How do you see your hub in 15 years' time (what are your ambitions in terms of circularity, bioeconomy, growth or expansion, size)?<br><br>What opportunities do you identify in terms of increasing sustainability or circularity and bioeconomy activities in your hub?<br><br>How are opportunities identified in your hub and how are development activities organized?<br><br>Do you have connections with R&D parties, education parties, or others, to develop the opportunities you see?</td>
</tr>
</table>

## Regional development

<table>
<tr>
<td rowspan="2">Playing field<br><br>Who are the key actors in advancing the bioeconomy in your hub?<br><br>What actor domains are present? Public, private, knowledge, education, society<br><br>Who are missing?<br><br>What are the formal competences of involved partners?<br><br>How is action between different actors coordinated? Is there a network or cluster organisation?</td>
<td>Capacities<br><br>What capacities are available for developing the regional bioeconomy, in terms of human capital, knowledge and skills..<br><br>Is there an established ongoing dialogue and cooperation between sectors, between public and private sectors, involving NGOs and representatives of the civil society?</td>
<td rowspan="2">Mission<br><br>What is the current state of the bioeconomy in your hub?<br><br>What are its impacts on the region?<br><br>What objectives for the bioeconomy do regional actors share and what are the differences?<br><br>Is there a regional bioeconomy strategy and what does it aim for?<br><br>Is there a clear mission? [tactical strategy]</td>
<td>Specialisation<br><br>What are the regional strengths, opportunities and comparative advantages for your bioeconomy hub and region?<br><br>What strategic choices have been made regarding a specialization within the bioeconomy?</td>
<td rowspan="2">Innovation pipeline<br><br>What activities are initiated to foster the bioeconomy in your hub?<br><br>How mature is the regional bioeconomy in its development?<br><br>What facilities and/or other supporting infrastructure are present?<br><br>How well is the bioeconomy hub anchored in civil society and within the strategies and activities of other quadruple helix actors? Please, mention 3 or more examples.</td>
</tr>
<tr>
<td>Finance<br><br>How are these activities financed?<br><br>Is funding available for initiatives and investments in the bioeconomy?</td>
<td>Learning<br><br>Is there a network of regional actors for joint learning -how is this organised? Does this learning process lead to adjusted and new activities? What are strong and weak points?</td>
</tr>
<tr>
<td colspan="3">Existing conditions – challenges and obstacles<br><br>What are the current challenges and obstacles for bioeconomy activities described above?<br><br>Please list at least 3 challenges/obstacles providing some contextualization.<br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc.</td>
<td colspan="3">Requirements – opportunities and enablers<br><br>What are the main enabling factors of the current bioeconomy hub, its mission and supporting activities?<br><br>What opportunities there are to develop further the bioeconomy hub, its mission and supporting activities? What outputs and outcomes are needed for the short term?</td>
</tr>
</table>

## Arts and Design

<table>
<tr>
<td rowspan="2">Key Partners<br><br>Who are already involved in the mentioned Key activities or providing Key resources? Individuals, companies, organisations, or other entities?</td>
<td>Key Activities<br><br>Which key activities are already running in your hub to support your intended role for art & design?</td>
<td rowspan="2">Role of Art & Design<br><br>Choose here one of the 4 described roles for art & design approaches. Relate all the other building blocks of the canvas to the chosen role.</td>
<td>Partner Relationships<br><br>What type of relationship do you have with your mentioned key partners and citizens & learners?</td>
<td rowspan="2">Citizens & Learners<br><br>Which citizens and (non-) formal learners are you already addressing by your key art & design activities?</td>
</tr>
<tr>
<td>Key Resources<br><br>Which key resources (finance & facilities) do already support the mentioned key activities</td>
<td>Channels<br><br>Which means do you have to communicate, continue, and strengthen the relationships with your mentioned key partners and citizens & learners?</td>
</tr>
<tr>
<td colspan="3">Weaknesses & Threats<br><br>Describe the weakness and treads of the existing key partners, activities, resources, partner relationships, channels and addressed citizens and learners. Think about the level and maturity of involvement, interest, impact, etc.</td>
<td colspan="2">Strength & Opportunities<br><br>Describe the strength and opportunities of the existing key partners, activities and resources, partner relationships, channels and addressed citizens and learners.</td>
</tr>
</table>

## Learning

<table>
<tr>
<td rowspan="2">Actors<br><br>Who are the key actors currently providing educational and training programmes of relevance for the purpose of bioeconomy practice uptake in the area/region?<br><br>What different sectors are involved?<br><br>What different kind of education providers are involved?</td>
<td>Technology and activities<br><br>What kind of learning activities and programmes are offered?<br><br>Please, provide an overview in terms of type (formal, non formal, awareness raising etc.), level (secondary school, higher education etc.) and formats (online, face to face, duration etc.), for various topics (skills) that are relevant for bioeconomy.<br><br>Please mention also the learning methods, if known, and what kind of innovation level they have.</td>
<td rowspan="2">Value proposition and activities<br><br>What is the impact of the current educational offer for the various learners groups?<br><br>What is the impact for the bioeconomy practices uptake?</td>
<td>Audience/learners<br><br>Who are the main audiences/learners of the learning activities?<br><br>Please, provide an overviews and link to the type of learning activities mapped.</td>
<td rowspan="2">External influences<br><br>Which kind of enablers or challenges not directly related to the regional context or sector have an impact on the current educational provisions?<br><br>Please, list a few enablers and a few challenges/obstacles.</td>
</tr>
<tr>
<td>Resources<br><br>How these mapped learning activities are funded and supported?<br><br>Please, provide an overview of the sources of funding, other forms of support and the impact on the activities relevance for the current bioeconomy practices.</td>
<td>Channels<br><br>How are the relevant learning activities you have described promoted to relevant potential learners?<br><br>Which channels are used and how efficient and impactful are they?</td>
</tr>
<tr>
<td colspan="3">Challenges and obstacles<br><br>What are the current challenges and obstacles for the provision of the education and learning activities described above?<br><br>Please list at least 3 challenges/obstacles providing some contextualization.<br><br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc, including also reference to the core dimensions of regional development for bioeconomy.</td>
<td colspan="3">Opportunities and enablers<br><br>What are the main enabling factors of the current educational provision of educational activities linked/relevant to bio-economies?<br><br>What are the opportunities to develop further the current for the provision of the education and learning activities described above?<br><br>Please list at least 3 enablers and 3 opportunities and provide some context.<br><br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc, including also reference to the core dimensions of regional development for bioeconomy.</td>
</tr>
</table>

# Annex 2: Canvases for gap analysis

## Regional development

<table>
<tr>
<td rowspan="2">Playing field<br>Who do you need to advance the bioeconomy in your hub?<br>How can the interplay of the quadruple helix be improved?<br>Is there a need for a different or adjusted type of coordination?</td>
<td>Capacity<br>How can the dialogue and cooperation be strengthened between sectors, between public and private sectors, involving NGOs and representatives of the civil society?<br>What capacities are needed for taking the next step of the regional bioeconomy?<br>What (type of) initiatives and activities should be started?</td>
<td rowspan="2">Mission<br>What is the desired future state of the bioeconomy in your hub?<br>What objectives for the bioeconomy do regional actors need to develop and agree with?<br>What does this imply for the regional bioeconomy strategy and what it aims for?<br>What would be the (options for) an adjusted mission?</td>
<td>Specialisation<br>What can or should the regional strengths, opportunities and comparative advantages become for your bioeconomy hub and region?<br>What strategic choices should be made regarding a specialization within the bioeconomy?<br>What choices and dilemmas are present?</td>
<td rowspan="2">Innovation pipeline<br>What activities should be initiated to further advance the bioeconomy in your hub?<br>What facilities and/or other supporting infrastructure are needed to implement the future mission?<br>How can the bioeconomy hub be anchored better in civil society and the other quadruple helix actors?</td>
</tr>
<tr>
<td>Finance<br>How should these new activities be financed?<br>How can funding be made available for the needed investments in the bioeconomy</td>
<td>Learning<br>How can the learning by regional actors as a network be organised to support the needed changes?<br>How can this regional actors learning process lead to adjusted and new activities?</td>
</tr>
<tr>
<td colspan="3">Future conditions – challenges and obstacles<br>What are the future challenges and obstacles for bioeconomy activities described above?<br>Please list at least 3 challenges/obstacles providing some contextualization.<br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc.</td>
<td colspan="3">Requirements – opportunities and enablers<br>What are the main enabling factors of the future bioeconomy hub, its mission and supporting activities?<br>What are the opportunities to develop further the bioeconomy hub, its mission and supporting activities?<br>What are needed future outputs and outcomes?</td>
</tr>
</table>

## Arts and Design

<table>
<tr>
<td rowspan="2">Key Partners<br><br>What individuals, companies, organisations, or other entities do you need for the mentioned key activities and related key resources?</td>
<td>Key Activities<br><br>Which key activities are needed in your hub to support your intended role for art & design?</td>
<td rowspan="2">Role of Art & Design<br><br>Chose here one of the 4 described roles for art & design approaches. Relate all the other building blocks of the canvas to the chosen role.</td>
<td>Partner Relationships<br><br>What type of relationship do you need with your mentioned key partners and citizens & learners?</td>
<td rowspan="2">Citizens & Learners<br><br>Which citizens and (non-)formal and learners would you address by your key art & design activities?</td>
</tr>
<tr>
<td>Key Resources<br><br>Which key resources (finance & facilities) do you need to have which support the mentioned key activities.</td>
<td>Channels<br><br>Which means do you need to communicate, continue, and strengthen the relationships with your needed key partners and citizens & learners?</td>
</tr>
<tr>
<td colspan="3">Weaknesses & Threats<br><br>Describe the weakness and threats of the need for key partners, activities, resources, partner relationships, channels and addressed citizens and learners. Think about the level and maturity of involvement, interest, impact, etc.</td>
<td colspan="2">Strengths & Opportunities<br><br>Describe the strength and opportunities of the need for key partners, activities and resources, partner relationships, channels and addressed citizens and learners.</td>
</tr>
</table>

## Learning

<table>
<tr>
<td rowspan="2">Actors<br><br>Who are the key actors that should be involved in providing educational and training programmes of relevance for the purpose of bioeconomy practice uptake in the area/region?<br><br>Please, focus on providing some reasoning on the actors that not yet involved and why their involvement would be beneficial.</td>
<td>Technology and activities<br><br>What kind of learning activities and programmes should be offered?<br><br>Please, provide an overview in terms of type (formal, non-formal, awareness raising etc.), level (secondary school, higher education etc.) and formats (online, face to face, duration etc.), for various topics (skills) that are relevant for bioeconomy.<br><br>Please mention also the learning methods that could most suitable, in your opinion, to support new learning activities.</td>
<td rowspan="2">Value proposition and activities<br><br>What would be the impact of the enhanced educational offer for the various learners groups?<br><br>What would be the specific impact for the bioeconomy practices uptake?</td>
<td>Audience/learners<br><br>For which learners group learning activities are missing, in particular?<br><br>Which learners group should be addressed more and/or with more specific activities?<br><br>Please, provide an overviews and link to the type of learning activities mapped.</td>
<td rowspan="2">External influences<br><br>Which kind of enablers or challenges not directly related to the regional context or sector can have an impact on the future/potential educational provisions?<br><br>Please, list a few enablers and a few challenges/obstacles.</td>
</tr>
<tr>
<td>Resources<br><br>How these new/enhanced learning activities could be funded and supported?<br><br>Are there sufficient funding and support for learning activities?<br><br>Please, provide an overview of the needed sources of funding and support and explain whether the funding/support is sufficient while not yet properly allocated to relevant activities.</td>
<td>Channels<br><br>How the new/enhanced learning activities should be promoted to relevant potential learners?<br><br>Which channels should be used to enhance the impact of the outreach for learning activities related to bio-economiy and its practices uptake?</td>
</tr>
<tr>
<td colspan="2">Challenges and obstacles<br><br>What are the challenges and obstacles for the provision of new/enhanced education and learning activities?<br><br>Please list at least 3 challenges/obstacles providing some contextualization.<br><br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc, including also reference to the core dimensions of regional development for bioeconomy.</td>
<td colspan="3">Opportunities and enablers<br><br>What are the main enabling factors for the provision of new/enhanced education and learning activities?<br><br>What are the opportunities for further education and learning activities?<br><br>Please list at least 3 enablers and 3 opportunities and provide some context.<br><br>Please provide relevant example at different level, such as policy, strategic planning, funding, participation, community support, etc, including also reference to the core dimensions of regional development for bioeconomy.</td>
</tr>
</table>

# Engage4BIO

> “Multi-stakeholder engagement to strengthen regional bioeconomy value-chains”

## Consortium :

ZSI

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APRE Agenzia per la Promozione della Ricerca Europea

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