

ADVANCED BIOBASED MATERIALS THEMATIC STUDIES

#7

BIO-BASED MATERIALS IN EUROPE:
STAKEHOLDERS MAPPING, PROJECTS &
PRIVATE SECTOR DYNAMICS, POLICY
ANALYSIS & RECOMMENDATIONS



THEMATIC STUDY OF THE BIOEAST THEMATIC WORKING GROUP ON ADVANCED BIOBASED MATERIALS

Bio-based materials in Europe: stakeholders mapping, projects & private sector dynamics, policy analysis & recommendations

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1. Context and purpose of the study

1.1. Context of the study

1. The BIOEAST initiative is an EC-funded project (Coordination & Support Action – CSA) which aims to foster knowledge-based circular and sustainable bioeconomy activities across Central & Eastern European Countries (CEEC).
2. The BIOEASTsUP project is an EC-funded scheme, built on the BIOEAST initiative, aiming at advancing the development of National R&I-driven bioeconomy strategies in CEEC.
3. This exercise is a collaborative one involving the 11 BIOEAST participating member-countries: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Bulgaria, Croatia, Romania, Slovakia, Slovenia.
4. The BIOEAST thematic focus is spread amongst various sub-themes of circular bioeconomy (each of them being supported by TWGs – thematic working groups), such as:
 - i. Agro-ecology and sustainable biomass production & farming systems;
 - ii. Bioenergy;
 - iii. Food systems and food security;
 - iv. Fresh-water blue economy;
 - v. Forestry value chains;
 - vi. Bio-based material.
5. The new programming period having started in 2021 is a pivotal moment for policy elaboration & development, and a few considerations are taken on board by the BIOEAST stakeholders:
 - a) The growing importance of Innovation within R&D&I policies: all types of technological innovation, but also responsible innovation, sustainable innovation, frugal innovation, social innovation, downstream innovation & open innovation;
 - b) The role played by SMEs, and innovative firms in the development of the R&I agenda, especially in rural areas;
 - c) The interaction between the new framework programme for R&I (Horizon Europe) and various Bioeconomy-relevant EU strategic initiatives: the European Green Deal, the new Bio-Economy Strategy, the new Circular Economy Action Plan, the new Circular bio-based Europe” (CBE) partnership, the new Biodiversity strategy, Next Generation EU, the new Industrial strategy for Europe, the new SME strategy, the new ESIF (European Structural & Investment Fund) and its I3 (Interregional Innovation Investment) component, the emphasis made on Climate Change, and of course the new CAP (Common Agricultural Policy) including the Farm-to-Fork (F2F) strategy.
6. Additionally to its European positioning, the place-based character of bioeconomy and bio-based industry and its anchorage to territories are conferring a strong regional and national dimension to bioeconomy strategies and projects, meaning this study will pay a special attention to regional and national programs and the background policy frameworks (RIS3 for example)
7. A Strategic Research & Innovation Agenda (SRIA) has been initiated and is currently developed for BIOEAST, and the current study aims to contribute to its further development and foresight perspective.

1.2. Purpose of the expert intervention

1. The aim of the expert intervention is to produce a study providing analysis and recommendations on the interactions between bioeconomy R&I policies and Common Agricultural Policy (CAP) 2021-2027, as far as bio-based material is concerned.
2. The expert will produce a study describing:
 - a) Links & relationships between R&I-driven bioeconomy at Regional & National levels and at EU (CAP) level;
 - b) Benefits generated by these R&I/CAP bioeconomy policy interactions for CAP core strategic objectives (such as F2F, Biodiversity, GHG emission, zero waste, ...);
 - c) Contribution of Green Biotechnology to CAP & Green Deal goals.
3. The study will include various approaches, such as:
 - a) General & specific stakeholders mapping;
 - b) Benchmarking of relevant bioeconomy initiatives & players;
 - c) Identification of emerging new business activities;
 - d) Interactions with the private sector;
 - e) Relevant EU-policies analysis;
 - f) Mapping of R&I and CAP Bioeconomy characteristics;
 - g) Identification & analysis of relevant bioeconomy Horizon Europe and CAP-funded projects;
 - h) Links between R&I bioeconomy and CAP policies;
 - i) Analysis of the impact of Green Biotechnology on Policies and looking forward recommendations.

2. Overarching challenges and relevant issues

General considerations

The context of this study is characterized by the mix of several overarching challenges which affect the ecosystems of bio-based products & materials, and which can equally create innovation & development opportunities. Most of them are correlated to the development of a more sustainable economy and the achievement of the European Green Deal, by shifting to bio-based products and processes, help reducing Europe's dependency to fossil fuels, and meet ambitious environmental, societal, industrial and climate policy targets.

The shift to bio-based economy, solutions & systems can significantly accelerate the transition to a green and circular economy, improve the management of bio-mass flows, and is already contributing to create new markets, new innovations, new businesses, new investments, new jobs, across numerous sustainable value-chains.

One of the overarching challenge impacting this bioeconomy transformation is not particularly related to the discovery of new technological processes, or even not the evolution of the demand for bio-based products, but the availability and predictability of biomass, and the interfering domino effect between the sectors of applications, especially the demand from the energy & biofuels industry.

Relevant challenges

Here are a selection of the challenges addressed by the bio-economy:

1. Intensive crop-dependent agriculture, and topsoil degradation
2. Preservation of biomass production potential (land and sea)
3. Conservative & regenerative farming systems
4. Safe food system and consecutive improved diets & health
5. Reduction of biodiversity
6. Climate action through carbon sequestration and storage
7. Recovery of organic by-products and wastes (reuse, recycling, remanufacturing)
8. Place-based local & rural services, with a spatial rural/urban improved balance

Specific policy observations

The Bioeconomy in general, and bio-based products and processes in particular, are increasingly present within most of the R&I EU policies & programmes, particularly Horizon Europe, Life and ERDF.

Despite of the efforts to green the CAP, his thematic positioning is not strong and explicit enough at the CAP level even if recent development of the new CAP final negotiations are encouraging

The relative importance of Bioeconomy within National policies & strategies is very contrasting and some Member States are still catching up or even lagging behind EU plans and expectations.

3. Bio-based material: what are we talking about?

Glossary

Biomass

Biomass is a term used to describe the organic material arising from living ecosystems, including forests, cultivated land and oceans. It can be extracted directly from ecosystems (timber harvesting), from production processes (agriculture), or by valorizing biomass residues and wastes which have been through previous use or production processes.

Bio-based

Derived from biomass (CEN/TC 411 2014). Biomass can have undergone physical, chemical or biological treatments

Bio-based content / Biomass content

Fraction of a product derived from biomass (CEN/TC 411 2014), normally expressed as a percentage of the total mass of the product.

Bio-based product

Product wholly or partly derived from biomass (CEN/TC 411 2014). The bio-based product is normally characterised by the bio-based carbon content or the bio-based content. Product can be an intermediate, material, semi-finished or final product.

Bioeconomy

The European Commission has defined bioeconomy as the production of biomass and the conversion of biomass into value added products, such as food, feed, bio-based products and bioenergy. It includes the sectors of agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries.

Bioenergy

Energy from biomass. (CEN/TC 411 2012)

Biofuel

Liquid or gaseous fuel for transport produced from biomass. (EU Renewable Energy Directive)

Definition of Bio-Based Material (BBM)

Bio-based products are derived from materials of biological origins, renewable & biodegradable by nature, holder of numerous functional attributes, destined to numerous food and non-food usages.

Bio-based products and materials are produced out of agriculture, livestock, forestry, weeds & herbs, aquatic biotopes, microbiological ecosystems, etc.

The main source of biomass remains agricultural crops, such as wheat, maize/corn, sugar beet, sugar-cane, flex, sunflower, but also natural medicinal herbs. Organic waste (agricultural

& food) constitutes another significant portion of biodegradable material for transformation into bio-based products.

The usages are multiple: energy (biofuels and biogas), lubricants & detergents, cosmetics, food ingredients, plant-based proteins, textiles, bio-plastics & packaging, polymers, fibers, ligno-cellulosic products, bio-fertilizers and bio-solutions for agriculture, etc.

Enzymatic processes, fermentation and bio-catalysis techniques are some of the industrial processes developed in biorefineries, the factories-of-the-future in the bioeconomy sector.

There are many different ways to classify this rapidly growing sector, and the typology might be considered across several angles: the origin of the biomass, the usages & applications, the nature of raw material, and the biotechnological processes used to generate the products.

Typology of origins

According to the EU Biomass Flows report, 69 % of the EU biomass is produced by agriculture, 30 % by forestry and 1 % by aquatic sources.

1. Agriculture
 - Primary agricultural crops
 - Dedicated crops cultivated for energy or bioprocesses' purposes
 - Primary residues
 - Secondary residues from harvest processing
2. Forestry
 - Stemwood/Timber production
 - Primary forestry residues
 - Secondary forestry residues & industrial by-products
3. Aquatic Biomass
 - Algae
 - Seaweed
4. Aromatic herbs
5. Waste biomass (Tertiary residues)
 - Municipal solid waste
 - Vegetal wastes
 - Sewage sludge and animal-based waste
 - Food waste
 - Wood-waste

Typology of usages

According to the EU Biomass Flows report, 60 % of the EU biomass use is for food & feed, 24 % for energy, and 16% for bio-materials. Here are a series of identified usages:

1. Bio-Mass for energy production
2. Bio-Mass for ignition fluids (including SAF-Sustainable Aviation Fuels) and lubricants
3. Bio-based natural fibers (including for automotive industry)
4. Bio-polymers for composite for automotive industry
5. Bio-based functional material for medical & cosmetic applications
6. Bio-plastics for food and non-food packaging
7. Bio-solutions for Agriculture (bio-fertilizers, bio-stimulants, etc)
8. Bio-active ingredients for food formulations

9. Bio-materials for sustainable building & construction
10. Bio-material for textile applications
11. Bio-material for paper products
12. Bio-additives for coatings & surface treatments

Typology of raw material

1. Oil & lubricants
2. Starch
3. Proteins
4. Polyphenols
5. Lignocellulose
6. Microbial strains

Typology of processes

1. Fermentation technologies
2. Chemical & enzymatic processes
3. Biomineralization
4. Purification
5. Fractionning & cracking

Bio-refineries

The concept of bio-refineries dominates the bioeconomy agenda and its industrial biotechnological aspect, as it appears to be the vehicle to scale the processes and generate real impact.

A recent (June 2021) study (“EU Biorefinery Outlook to 2030”) provides a very detailed and interesting perspective on the matter, and presents scenarios on how demand and supply for bio-based chemicals and materials could grow to 2030.

4. European policy update

4.1. EU Bioeconomy strategy

The Bioeconomy strategy aims to accelerate the deployment of a sustainable European bioeconomy, ensuring food and nutrition security, managing natural resources sustainably, reducing dependence on non-renewable resources, contributing to the European Green Deal, as well as industrial, circular economy and clean energy innovation strategies. As it appears from the below bioeconomy action plan, there are a number of themes highly relevant for bio-based materials.

Area I: Strengthen & scale up the biobased sectors, unlock investments & markets

1. mobilise stakeholders in developing and deploying sustainable biobased solutions
2. launch a €100 million circular bioeconomy thematic investment platform
3. analyse enablers and bottlenecks for the deployment of biobased innovations
4. promote and develop standards
5. facilitate the deployment of new sustainable biorefineries
6. develop substitutes to fossil-based materials that are biobased, recyclable and marine biodegradable

Area II: Deploy local bioeconomies rapidly across the whole of Europe

1. launch a strategic deployment agenda for sustainable food and farming systems, forestry and biobased products
2. launch pilot actions for the deployment of bioeconomies in rural, coastal and urban areas
3. support regions and EU countries to develop bioeconomy strategies
4. promote education, training and skills across the bioeconomy

Area III: Understand the ecological boundaries of the bioeconomy

1. enhance knowledge on biodiversity and ecosystems
2. monitor progress towards a sustainable bioeconomy
3. promote good practices to operate bioeconomy within safe ecological limits
4. enhance the benefits of biodiversity in primary production

4.2. EU Forest Strategy for 2030

Forests have long held a hugely important role in our economy and society, creating jobs and providing food, medicines, materials, clean water and more

This new EU Forest Strategy aims to overcome these challenges and unlock the potential of forests for our future. It is anchored in the European Green Deal and the EU 2030 Biodiversity Strategy and it recognises the central and multi-functional role of forests.

Sustainable raw wood and non-wood materials and products are key in the EU's transition to a sustainable climate-neutral economy. Wood used for the production of short-lived products and also for energy production should rely on wood that is unsuitable for long-lived materials and products, and secondary woody biomass such as sawmill by-products, residues and recycled materials. Technological advances already facilitate processing of woody biomass residues and waste for circular innovative materials and products thus diversifying the bio-based

products and offering climate-friendly solutions for new or emerging application areas. Wood based bioenergy is currently the main source of renewable energy, supplying 60% of EU's renewable energy use. To meet the at least 55% emission reduction target by 2030, Member States will need to significantly increase the share of renewable sources in their energy mix.

Where no effective wood material utilisation is possible, bioenergy will also continue to have a role to play in improving the livelihoods of primary producers, namely foresters and farmers, and diversifying forest-based economic opportunities in rural areas. The additional revenue from bioenergy markets can ensure revenues to forest owners and managers in all stages of sustainable forest management, and with that help secure a regular income from their land. EU forests provide highly valuable non-wood products, such as cork (80% of the worldwide production), resin, tannins, fodder, medicinal and aromatic plants, fruits, berries, nuts, roots, mushrooms, seeds, honey, ornamentals and wild game, which often benefit the local communities.

4.3. EU Farm-to-Fork strategy (F2F)

The F2F Strategy is of particular importance for agriculture and food, as it calls for an alignment of the EU agricultural & food system to the Green deal. It defines 6 objectives:

- Ensuring sustainable food production
- Ensuring food security
- Stimulating sustainable food processing & retail
- Promoting sustainable food consumption & healthy diets
- Reducing food loss & waste
- Combatting food fraud along the food chain

This strategy is very strongly connected to circular economic principles, from the farmers to the consumers, and are in-line with the bioeconomy values.

4.4. Common Agricultural Policy (CAP)

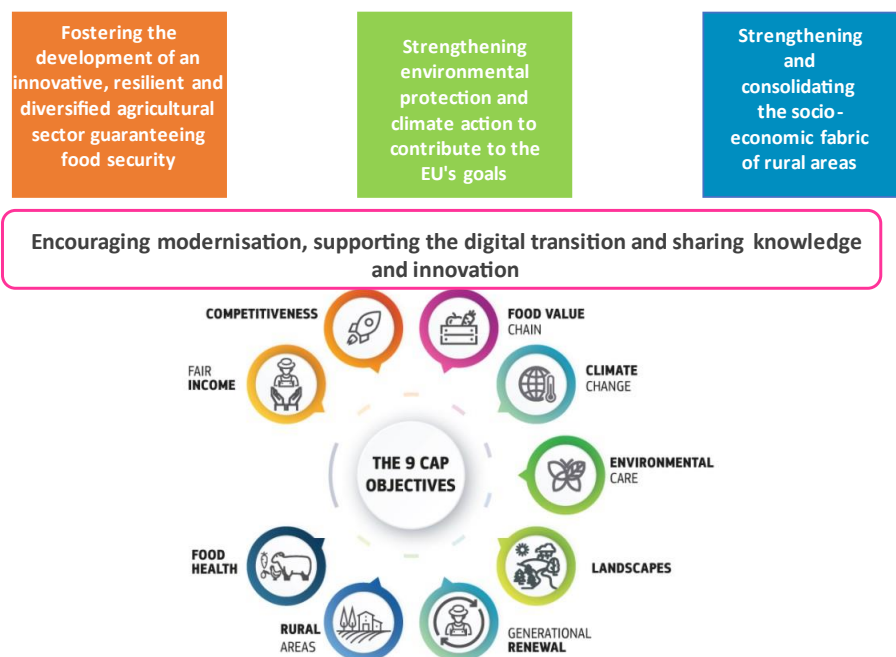
CAP objectives and CAP Strategic Plans

The CAP post 2020 will be implemented through national CAP Strategic Plans. These cover the whole CAP, both funds (EAGF and EAFRD) with direct payments, rural development and sectorial interventions. There will be one CAP strategic plan per MS (see figure) with one single Managing Authority who will be the only contact for the Commission.



The CAP post 2020 has three general objectives (article 5 of the legislative proposal), namely (1) foster a smart, resilient and diversified agriculture ensuring food security; (2) bolster environmental care and climate action contributing to these EU objectives; (3) strengthen the socio-economic fabric of rural areas. A cross-cutting objective of modernisation of the sector by fostering knowledge, innovation and digitalisation of agriculture and rural areas accompanies and supplements the general objectives.

Nine specific objectives (article 6 of the legislative proposal) support the achievement of the general objectives (see figure).



Agriculture & Green Deal

Agriculture occupies a unique position at the heart of the European Union's society, environment and economy. Agricultural activity is sustained by good environmental conditions, which allow farmers to harness natural resources, create their produce and earn a living. The CAP therefore combines social, economic, and environmental approaches on the path towards achieving a sustainable system of agriculture in the EU. Further steps in this path will be taken in the new CAP which is built around a renewed and more ambitious green architecture, also by hooking on the latest advances in knowledge and innovation, and aligned with the European Green Deal.

Farmers, agri-food businesses, foresters, and rural communities have an essential role to play in several of the Green Deal's key policy areas, including:

- building a sustainable food system through the Farm to Fork strategy;
- adding to the new biodiversity strategy by protecting and enhancing the variety of plants and animals in the rural ecosystem;
- contributing to the climate action of the Green Deal to achieve the goal of net-zero emissions in the EU by 2050;
- supporting the new forestry strategy by maintaining healthy forests;
- contributing to the zero pollution action plan by safeguarding natural resources such as water, air and soil.

The Green Deal with its Farm to Fork strategy, the Biodiversity strategy (but also the Climate Law and the action plan for Circular Economy) and their Communications were adopted in December 2019 thus after the legislative proposal for the CAP reform from June 2018. This is important to highlight. They show the higher ambition with regard to environment and climate. But the post-2020 CAP will have to be compatible with the Green Deal objectives and CAP Strategic Plans should explicitly address this higher environmental and climate ambition.

Networking and Innovation in the CAP

Initiated with the European Network for Rural Development (ENRD), the networking activities of the 2nd pillar of the CAP were enlarged to the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI). The overarching concept of the EIP-AGRI is that of interactive innovation, where the knowledge does not only come from science, but from a multiplicity of stakeholders (farmers, advisors, SMEs, scientists, etc.) who collaborate. The EIP-AGRI is also about creating synergies between existing EU policies, like Horizon Europe. At the European level, EIP-AGRI network is run by the European Commission and is supported by the EIP-AGRI Service Point. It is an EU-wide network which supports EIP-Agri activities by fostering exchange of information and interaction and by facilitating the inclusion of the different stakeholders. The post 2020 CAP maintains and expands the existing two networks, the ENRD and EIP Agri into a European CAP Network.

EU Biodiversity & the CAP

The EU Biodiversity Strategy for 2030 acknowledges the loss of biodiversity and recommends to take action to limit the deterioration of ecosystems. It has to be taken account as it correlates to biodiversity objectives which are relevant to the bio-based material value chains, such as organic farming, diversified farming systems and promotion of proactive policies of tree planting and soils decontamination.

Bioeconomy & the CAP

Bioeconomy will play a crucial role in delivering the European Union's environmental and climate neutrality agenda. At least half of the nine objectives of the post-2020 EU Common Agricultural Policy (CAP) relate directly to this concept.. The recently updated bioeconomy strategy is closer to the concept of circular economy than to the mere re-use of energy, with the aim to strengthen and scale up an already vibrant European bio-based sector.

- Insulating homes, producing bioplastics, making organic fertilisers out of wastes: the application of the bioeconomy to the agriculture production creates new business opportunities, provides additional income for farmers and increases their competitiveness
- But it also strengthens the role that the agriculture sector could have in environmental care and the protection of biodiversity.

CAP: what's in it for bioeconomy & bio-based materials?

The first consideration to bear in mind are the limitations set by the TFEU (Treaty for the Functioning of the European Union) for CAP fundings for anything beyond the agricultural production sector (State-Aid regulations), meaning very little CAP funding opportunities are being available for transformative bio-industrial activities.

This is actually a bit a contradiction with some of the CAP's objectives, such as the strengthening of the socio-economic fabric of rural areas, the improvement of farmers' positions in value chains. The rural development' objectives (second pillar of the CAP) even aims – through the EAFRD and Rural Development Programmes (RDPs) – to “promote food chain organization, including processing and marketing of agricultural products” (Regulation (EU) 1305/2013).

The reference to bioeconomy in the CAP is weak and it's not a surprise there are very little schemes and relevant examples. Some can be found within the portfolio of EIP Agri multi-actors projects), such as:

- Enabling (www.enabling-project.com): Enhancing new approaches and boosting the potential of biomass-to-biobased value chains
- AgrolnLog (www.agroinlog-h2020.eu): Demonstrating Integrated Biomass Logistics Centres for food & non-food products
- LexBio (www.lex4bio.eu): Optimizing bio-based fertilizers for agriculture

Other interesting policy orientations might be explored for being potential sources of CAP (or CAP-associated) support to BBM farmers-entrepreneurs:

- The search for a greener CAP, achieving higher green ambitions on environment and climate action; the BBM and biorefineries value chains are obviously ticking this box.
- The announced provision of €10 Billion by Horizon Europe for R&I projects related to food, farming, rural development and bioeconomy – see also § 4.E below
- The new Rural Development Programme (RDPs) and some of its new features (Smart Villages initiative, maybe)
- The territorial specificities which could be adopted for the national CAP Strategic Plans, in particular the investment support for on-farm processing & marketing of agricultural products, and the support to young and new farmers
- The CAP's intention to improve competitiveness and further support the position of farmers in the value chains through (a) Coupled Income Support (CIS) mechanisms, (b) sectoral interventions and market orientation (but very limited scope)
- The articulation & synergies between CAP funds and Regional Structural Funds - see also § 4.F below.

4.5. Horizon Europe (HE)

General introduction

Horizon Europe is the EU's key funding programme for research and innovation. It tackles climate change, helps to achieve the UN's Sustainable Development Goals and boosts the EU's competitiveness and growth. The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting and implementing EU policies while tackling global challenges. It supports the creation and better diffusion of excellent knowledge and technologies. It aims to boost economic growth and promotes industrial competitiveness.

HE is built around 4 pillars: (I) Scientific excellence, (II) Societal & industrial Challenges, (III) Innovation, (IV) Widening. It is also articulated across 5 Missions and a number of European Innovation Partnerships.

What's in it for bioeconomy & bio-based materials ?

HE is very much oriented towards bioeconomy, thanks notably a strong influence of the Green Deal directionality. The main sections of HE which are definitely bio-based economy/materials-friendly are:

- **Pillar II – Cluster 6:** Food, Bioeconomy, Natural Resources, Agriculture & Environment. This cluster aims at reducing environmental degradation, halting and reversing the decline of biodiversity on land, inland waters and sea and better managing natural resources through transformative changes of the economy and society in both urban and rural areas. It will ensure food and nutrition security for all and steer and accelerate the transition to a low carbon, resource efficient circular economy and sustainable bioeconomy, including forestry. Areas of intervention are: environmental observation; biodiversity and natural resources; agriculture, forestry and rural areas; seas, oceans and inland waters; food systems; bio-based innovation systems in the EU's bioeconomy; circular systems.
- **Pillar III –EIT-KICs** (Raw Material, Food, InnoEnergy) and EIC
In this report, we analyze a selection of BBM-oriented projects selected from their respective portfolios
- **Partnerships:** “Circular Bio-Based Europe” and “Sustainable & Productive Blue Economy”
In this report, we analyze a selection of BBM-oriented projects selected from their respective portfolios
- **Missions:** “Soil Deal for Europe” - Towards Healthy Soils.

Structural Funds

EU Cohesion Policy contributes to strengthening economic, social and territorial cohesion in the EU, and aims to correct imbalances between countries & regions, by contributing notably to the green and digital transition. It serves 5 sustainable growth policy objectives for the period 2021-2027:

1. a more competitive and smarter Europe;
2. a greener, low carbon transitioning towards a net zero carbon economy;
3. a more connected Europe by enhancing mobility;
4. a more social and inclusive Europe;
5. Europe closer to citizens by fostering the sustainable and integrated development of all types of territories.

The European Regional Development Fund (ERDF) will support investments in all 5 policy objectives, but 1 (a competitive & smart economy) and 2 (a greener transitioning economy) are the main priorities.

The Research and innovation strategies for smart specialisation' (RIS3) conditionality encourages the design of national or regional research and innovation strategies for smart specialisation, and Bioeconomy becomes a priority for a growing number of regions.. However, too few regions have a specific integrated strategy for Bioeconomy, by contrast with ad-hoc/sector-specific strategies (e.g. on energy, food, waste). This indicates that while Bioeconomy sectors are important and prevalent in regional strategies, creating Bioeconomy strategies as holistic and horizontal understanding of all the sectors is only starting to gain ground.

It is worth noticing that the TSSPs (Thematic Smart Specialization Platforms) and the new I3 (Interregional Innovation Investment) initiative pay growing attention to Bioeconomy, with active partnerships in Bioeconomy (Lignocellulose biorefinery, Biobased aromatics, Liquid biomethane), in Chemicals (Plastics recycling), Agri-Food (Nutritional Ingredients, Sustainable packaging), Energy (Bio-energy, Bio-fuels)), and sustainable Blue Economy.

A number of Regions are taking these areas very seriously and could be qualified as “advanced bio-economy regions”, such as for example Central Denmark, Varmland, Ostergotland, Satakunta, Kainu, North Karelia, Lombardy, Emilia-Romagna, Asturias, Navarra, Lodzkie, Mazowieckie, Kosice, Upper Austria, Flanders, Wallonia, Limburg, Gelderland, Delta, Grand Est.

EU Plastics Strategy

“A European strategy for plastics in a circular economy”, the European Strategy for Plastics sets clear goals to curb plastic waste and increase resource efficiency, by supporting innovative bio-based plastics solutions. The EC also emphasized the importance of biodegradable and compostable plastics made from renewable raw materials, as a sustainable alternative to recycled plastics. While the increase of recycled content in plastics is important to reduce virgin fossil feedstock, alternative sustainable feedstocks such as bio-based feedstocks need to be encouraged as well in order to defossilise the plastics economy.” At the same time, the mobilisation of EU-grown biomass for the production of bio-based plastics would provide impulses for jobs and growth in the bioeconomy sector and the opportunity to EU farmers to valorise side streams and by-products.

The flagship bio-based material for biodegradable plastics is PLA (PolyLactic Acid), a biodegradable bio-compostable polymer, produced from maize starch. It is also used as material for 3D-printing. A lot of research and technology development are made to improve the properties of the PLA, used alone or combined with lignin.

5. Stakeholder mapping

Complementarily to the BIOEASTsUp partners, the approach was to look outside/aside of the Research circles and to focusing on innovation funding bodies and territorial players, including clusters which are traditionally in closer contacts with SMEs and innovators

The exploration of investment platforms, incubators & accelerators has provided very useful insights confirming the exponential generation of business support & investment intermediaries & Funds

Analyzing other EU or International initiatives also brought confirmation of a series of trends in policy priorities and financial/non-financial support instruments.

Here is a selection of stakeholders and players:

European Institutions

1. DG AGRI, in particular Directorate B (“Sustainability”) and Directorate F (Research & Innovation)
2. DG RTD, in particular Directorate B (“Healthy Planet”)
3. DG ENVI, in particular Directorate B (“Circular Economy”)
4. DG REGIO, in particular Directorate G (“Smart & Sustainable Growth”)
5. EIB (European Investment Bank)
6. EIC (European Innovation Council)
7. EIT (European Institute for Innovation & Technology)

European Innovation Partnerships

1. CBE (Circular Bio-Based Europe), former BBI-JU
2. Climate Neutral Sustainable Blue Economy
3. EIT Food
4. EIT Raw Material
5. EIP Agri
6. Eurostars (“Innovative SMEs”)

European Platforms & Alliances

1. Circular Plastic Alliance (CPA)
2. Circular Bioeconomy alliance (CBA)
3. Blue Bio Alliance (BBA)
4. Others

European Professional & Industrial organizations

1. Business Europe
2. CEFIC
3. Starch Europe
4. EuropaBio
5. Fediol
6. Bio-Plastics Europe
7. BioEnergy Europe
8. Others

Members States

1. National Ministries
2. Governmental Agencies

Universities and Research Institutes

3. BISC (Bio-Material Scale-Up Center)- RISE, Stockholm (SWE)
4. NOVA Institute, Huerth (DE)
5. Bio Economy Research, Hohenheim University (DE)
6. European Forest Institute (EFI), Joensuu (FIN)
7. CEBB (Centre Européen de Biotechnologie et Bioéconomie), Reims (F)
8. Materia Nova, Mons (B)
9. Politecnico Milano (IT)
10. VTT, Helsinki (FIN)
11. Tekniker, Eibar (ES)
12. Plastics Innovation Competence Center PICC, Fribourg (CH)
13. Plast Center Denmark, Esbjerg (DK)
14. Thunen Institute, Brunswick (DE)
15. Tecnalia, San Sebastian (ES)
16. Many others

Cluster organizations

1. Bio Cluster Central Denmark, Viborg (DK)
2. Valorial, Rennes (F)
3. Bio-Economy for Change (B4C) - IAR, Reims (F)
4. Wagraim, Charleroi (B)
5. Heidner NCE Bio-Cluster (NW)
6. Circular Bioeconomy South West, Tralee (IRL)
7. Food & Bio-Cluster Denmark (DK)
8. Cluster Industrielle Biotechnologie, Dusseldorf (DE)
9. Latvian Food Bioeconomy Cluster (LV)
10. Clust-ER Greentech, Bologna (IT)
11. Circular Biobased Delta (NL)
12. Polymeris, Oyonnax-Lyon (F)
13. BioVale, Yorkshire (UK)
14. Packaging Cluster, Sabadell (ES)
15. Many others

Incubators & Accelerators

1. Start-Life, Wageningen (NL)
2. Foodbytes by Rabobank (NL)
3. Good Food market by Barilla (IT)
4. Mistafod by Givaudan (CH)
5. The Unilever Foundry (NL)
6. Atlanpole, Nantes (F)
7. JIC, Brno (CR)
8. NOVACHIM, Marseille (F)

Venture Capital Funds

1. ECBF (European Circular Bioeconomy Fund)
2. Sofinnova (F)
3. Seventure – Blue Economy Fund (F)
4. VTT Venture (FIN)
5. Tecnalia Venture (ESP)
6. BASF VC
7. SOLVAY Ventures
8. Rhodia ventures

6. Bio-based material: the private sector dynamics

The following list of Companies (Large Corporations, Mid-caps, SMEs, start-ups and scale-ups) has been established by analyzing:

- the portfolios of several investment platforms;
- the cohorts of several accelerators, incubators and clusters;
- the portfolios of several relevant European programmes and of National Innovation Funding Bodies;
- the reality of their business existence sustainability, their trading status and TRL position; company's web-sites have been duly checked;
- the correspondence with the BIOEASTsUP innovation areas, including the attention given to emerging innovations presenting both a vision relevance and an economic sustainable development potential.

A few Corporate leaders

Increasingly present through their Corporate Research & Innovation Centres, or their Corporate Venturing branches, here is a list of relevant & engaged industry leaders:

1. BASF
2. NOVAMONT
3. ROQUETTE
4. PURATOS
5. STORA-ENSO (Innovation Centre or bio-materials)
6. UPM
7. ARJO WIGGINS
8. ARKEMA
9. NESTE ("The Biofore Company")
10. COVESTRO
11. SOLVAY
12. ROYAL DSM
13. BOREALIS
14. EVONIK
15. LIMAGRAIN

Selected leading SMEs

1. GALACTIC (B) – www.lactic.com
Lactic acid and derivatives, natural antimicrobials & ingredients
2. COSUCRA (B) – www.cosucra.com
Natural ingredients extracted from chicory roots and peas
3. TRIBALLAT NOYAL (F) – www.triballat-noyal.com
4. VALOREX (F)
Functional food ingredient extracted for flax seeds
5. ALGAEING (ISR)
Bio-textile innovation using renewable algae
6. GELATEX TECHNOLOGIES (EE)
Bio-based nanofibers for leather alternatives uses

7. SCINDO (NW)
Enzymatic cracking of plastics waste for feedstock uses
8. UBQ (ISR)
Composite material manufacturing from municipal solid waste
9. LACTIPS (F)
Milk-proteins (Caseins) as raw material
10. AD-BIO PLASTICS (ESP)
Bio-based polymers
11. WOODO (F)
Bio-based polymers
12. PURAFFINITY (UK)
Bio-based polymers
13. BIOMED ELEMENTS (DE)
Bio-based polymers

7. Bio-based material: start-ups on the move

A particular attention was made to identify the dynamics of business creation (Start-ups, Spin-offs) and early-stage business growth, as this indicates what are the emerging areas of applications

European Circular Bioeconomy Fund (ECBF)

This Venture capital Fund has been created by several investors and has supported a selection of growing firms, potentially bioeconomy success stories:

1. APHEA BIO (B)
Naturally occurring microorganisms for reduction of use of fertilizers and increased control of fungal diseases for maize and wheat
2. PEEL PIONEERS (NL)
Extracting orange oil from orange peels for food (beer, lemonade, waffels) and non-food (cosmetic, detergents) uses
3. PROLUPIN (DE)
Extraction & isolation of sweet lupin-based proteins, substituting soy, and offering an multi-uses ingredient with excellent food consistency
4. ELICIT PLANT (F)
Exogeneous supply of phytosterols, a plant-based molecule which improves plants' resistance to water stress and shortage

EIT Food

1. NAPIFERYN BIOTECH (PL)
Proteins from the material left over after pressing oil from rapeseed, with unique functional properties
2. ENVOPAP (UK)
Agricultural waste-based ecologically viable printing and packaging products
3. BETTER ORIGIN (UK)
Transform organic waste into sustainable agricultural inputs, using an insect called the Black Soldier Fly as a conversion catalyst.
4. DRYGO (UK)
Sustainable, whole-plant protein ingredient called "water lentils" as an alternative to soy or pea protein.
5. ENGINZYME (SW)
Production of foods based on enzymatic biomanufacturing utilising immobilized enzymes, and bringing to the market a novel prebiotic sugar
6. FYTEKO (B)
Creates Bio-stimulants and Biomolecules to improve crop yield and protect against abiotic stress.

EIT Raw Material

1. BIOKEMIK (ESP) – www.biokemik.eu
Sustainable high-value green bio-chemicals (bio-butadiene, bio-butanediol, bio acetoin)
2. BAMBOODER (NL) – www.bambooder.nl

- Extraction of bamboo's fibers for high-performance composite applications
3. AGRISTAR BIO (P) – www.agristarbio.com
Producing organo-mineral fertilizer by biosolids treatment system
 4. BIOTATEC – www.biotatec.com
Energy-efficient bioleaching technologies for different ores and type of waste

BLUE bio-economy

1. Est-Agar – www.estagar.ee
Red seaweed extracted gelling and texturant agent (Furcellaran)
2. Vetik – www.vetik.eu
Colourant from red seaweed biomass for cosmetics
3. Eranova – www.eranovabioplastics.com
Bio-plastics created from green macro-algae
4. Algama – www.algamafoods.com
Micro-algae healthy nutrients & food
5. Next protein – www.nextprotein.co
Insect-based protein for animal feed stocks
6. Glowee – www.glowee.com
Marine micro-organisms-based bioluminescence
7. Algoliner – www.algoliner.de
Closed system algae biomass photobioreactor
8. Biofabrik – www.biofabrik.com
Plastics catalytic depolymerization
9. Ocean Basis Kiel – www.oceanbasis.de
Cosmetics & nutraceuticals from Algae
10. Danvos – www.danvos.nl
Seaweed biorefinery for protein extraction and bioplastics production
11. Alginor – www.alginaor.no
Seaweed farming and biorefinery
12. Origin by Ocean – www.originbyocean.com
Blue-green algae, seaweed and bladderwrack farming, refinery & purification for natural food, cosmetics, pharma & detergents

EIC Accelerator

1. BIOWEG (DE)
High-purity cellulose-based microspheres & hydrocolloids for cosmetics, nutraceuticals and food & beverage sector
2. CO2BIOCLEAN (DE)
Carbon dioxide-based polymers for biodegradable textile fibers
3. PLANETCARE (SI)
Microfiber filters for washing machines preventing microplastics pollution
4. SENSONEO (SK)
Waste management solutions for cities
5. CHRYSALIX TECHNOLOGIES (EE)
Second life of wood: bioflex technologies to dissolve waste wood into raw material

Others

1. KEBONY, Oslo (NW)
Timber modification technologies for sustainable wooden building materials

2. ARBIOM (F)
Converts wood into an alternative protein source for animals and humans.
3. RE-GRAINED (US)
Upcycling brewer spent grain into snacks
4. FOODITIVE (NL)
Plant-based sweeteners & additives
5. CELLAOUATE (F)
Cellulosic thermic isolants produced from recycled newspapers
6. BALLECONCEPT (F)
Rice balls processed to provide bio-based construction materials
7. BIOMAT (B)
Low carbon footprint bio-based construction bricks
8. HIPPER-PACK/HPP (B)
Clean label food conservation through High pressure Processing

8. EU-funded collaborative projects portfolio

BBI/CBE (Circular Bio Economy)

The Bio-Based Industry Joint Undertaking, now called Circular Bio Economy (CBE) is classifying its projects amongst 5 categories of feedstock origins: Lignocellulose, Forest-based, Agriculture-based, Aquatic Biomass, Biowaste & CO₂ capture. Here are a few projects considered as success-stories, or at least promising collaborative research partnerships:

1. EUCALIVA
Sustainable lignin-based (Eucalyptus) industrial polymers & carbon fibers
2. SHERPACK
Cellulosic biodegradable & recyclable paper-based packaging
3. BIOMOTIVE
Advanced Biobased polyurethanes & fibres for the automotive industry
4. ZELCOR
Zero-waste ligno-cellulosic Biorefineries by Lignin valorization
5. SCALE
Supplying bio-actives compounds from micro-Algae
6. ALEHOOP
Biorefineries for valorizing macro-algae residual biomass
7. BIOCOMEM
BB copolymers for membrane end products for gas separation
8. ECOXY
BB fiber-reinforced Epoxy composites for automotive & construction
9. EFFECTIVE
Eco-designed fibres & films from BB polyamides & polyesters
10. OPTISOCHEM
Conversion of residual wheat straw to bio-isobutene for BB chemicals
11. PULP2VALUE
Processing underutilized Low value sugar beet pulp
12. SWEETWOODS
Flagship demo-plant biorefinery producing wood high-quality lignin.

EIT Food

1. PACK4SENSE
Recyclable paper packaging for sensitive foods
2. NORDICCEREALS
Converting waste from oat processing
3. PHENOLIVA
Valorization of olive mill waste as polyphenols

EIP-AGRI

The European Innovation Partnership for agricultural productivity and sustainability (EIP-Agri) promotes and fund multi-actors transnational R&I projects (funded by Horizon Europe), as well

as other CAP-funded networking initiatives. There are very few projects which match with the Bio-Based Materials agenda. Here are some:

1. MINAGRIS
Micro- and nano-plastics in agricultural soils
2. MAGIC
Marginal lands for Growing industrial crops
3. ENABLING
Enhance new approaches in Bio-based local innovation
4. PANACEA
Design the penetration path o non-food agricultural crops

Horizon 2020

1. BIOBARR (www.biobarr.eu)
New bio-based food packaging with enhanced barrier properties
2. BIOSMART
Bio-based compostable food packaging
3. KARMA2020
Keratin extracted from feathers
4. FIRST2RUN
Biorefinery value-chains for underutilized oil crops grown in arid and marginal lands
5. CHIMIO
Biorefinery platform transforming crustacean shell waste into chemicals to produce bio-based biopolymers
6. Others

9. Analysis of national context

A mapping exercise, a literature review and some interviews have been conducted with BIO-EASTsUP Member States and stakeholders with the purpose to determine what are the possible future directions of industrial biotechnology in the respective countries, what is the role of advanced bio-materials in the different sectors of applications, what are the trends as regards the way biomass is used and processed, and how are the bioeconomy ecosystems organized.

Hungary

The bioeconomy is being developed through a non-mandated bottom-up process (inter-ministerial discussions, concept note and position paper) and through a mandated top-down whole of government approach involving engagement with the OECD on introducing circular economy and addressing waste management challenges. Developments on the circular economy are now being mirrored in all MS. In such cases, there is a clear need to develop aligned approaches regarding Circular Economy Development and bioeconomy development.

Identified stakeholders:

- Ministry of Agriculture, Dept of Agricultural Research and Agri-Environmental management
- Budapest University of Technology and Economics
- Ministry of Innovation & technology
- Pannon University, Circular Economy-based Sustainability Competence Center
- Hungarian Plastic Scientific Cluster
- Hungarian Plastic Association
- Bay Zoltan Research Institute – Hungarian Bioeconomy Cluster
- DBH Investment
- Filaticum

Czech Republic

A BIOEAST HUB CZ has been established with the goal to promote Bioeconomy development. It has more than 100 stakeholders as members including research institutions, technology platforms, SMEs and NGOs. The hub provides support for the inter-ministerial group and policy makers. Currently, there is no political agenda for a Czech national bioeconomy strategy but this Hub is developing a concept paper as a first step for the future national bioeconomy strategy and to support the development of a strategic research and innovation agenda

Identified stakeholders:

- Mendel University Brno, Dept of Law & Social Sciences, Faculty Business & Economics
- South-Moravia Regional Innovation Agency (JIC), Brno
- Technology Center of the Czech Academy of sciences, Prague
- Czech Technology platform Plants of the Future

Estonia

There is a National Bioeconomy strategy under development. Estonia has requested a total of €982.5 million in grants under the RRF. The Estonian plan is structured around six pillars including the: the green transition in enterprises (“Green leaf”) which has a focus and a funding allocation in relation to the bioeconomy. Projects in the plan cover the entire lifetime of the RRF until 2026. The plan proposes measures in six of the seven European flagship areas and

will fund not only investments but also expertise (project development assistance – PDA) to improve the implementation of investments.

Identified stakeholders:

- Tallinn University of Technology, Dept of Chemistry and Biotech
- Enterprise Estonia

Latvia

The Latvian government published a national bioeconomy strategy in 2017, and is probably a pioneer in Central Europe. The State Institute of Wood Chemistry's provided a good example how to proceed with different kind of funding from research towards a business case. The project started as a research funded activity EU funding (ERDF) was used in the beginning. The private sector participated in the second phase of ERDF-funded project where TRL level 4-6 was and a pilot scale technology demonstration were developed. The project is now examining if industry partners are interested in scaling up the innovation to TRL 7-8.

Identified stakeholders:

- Latvian State Institute of Wood Chemistry
- Latvian Food Bioeconomy Cluster

Poland

There is no dedicated bioeconomy strategy yet, but there are strong linkages to Bioeconomy within the national Smart Specialization Strategy.

Identified stakeholders:

- Institute of Natural Fibres and Medicinal plants – National Research Institute
- Institute of Agricultural and Food Biotechnology - National Research Institute
- Polish Technology platform on Bioeconomy, Lodz
- AgroBioCluster, Mazowieckie region
- West Pomeranian Bioeconomy Cluster, Szczecin

Croatia

There is a S3 strategy addressing food and bioeconomy, with a special focus on wood production and processing.

Identified stakeholders:

- Ruder Boskovic Institute, Dept of Materials Chemistry
- University of Zagreb, Faculty of Chemical Engineering
- University of Zagreb, Faculty of Food Technology and Biotechnology

Slovakia

Identified stakeholders:

- National Forest Centre, Forest Research Institute
- BioEconomy Cluster, Nitra

Lithuania

There is no dedicated bioeconomy strategy yet.

Identified stakeholders:

- National Food Cluster
- Lithuanian Plastic Cluster

Slovenia

There is a number of national strategies linked to bioeconomy, such as the S3 one focusing on biomass transformation and new bio-based materials and technologies.

- National Institute of Chemistry

Romania

- National Institute of R&D for Biological Sciences, Dept of Biotech

Bulgaria

- AgroBioInstitute, (Ministry of Agriculture, Food & Forestry)

10. Looking forward recommendations

Here are a 10 recommendations aiming to catalyze the development of bioeconomy R&I policies and CAP policy in the BIOEAST countries for the next 2021-2027 programming period

1. **BIOECONOMY SRATEGIES: Accelerate the co-creation & adoption of national bioeconomy strategies**

It is important to influence National policy-makers so that a process to define national bioeconomy strategies is initiated and completed, including appropriate open consultation with relevant stakeholders from the private sector (from farmers to large Corporates), academia and public sector. Apart from Latvia (having completed this exercise), several CEEC countries are in the process of doing so, but this should be accelerated

2. **ENRICH S3: Further develop the Bioeconomy and BBM dimension of national and regional S3 strategies, and define & deepen key-areas of specialization**

Based on the recent virtuous development of the S3 concept in CEEC countries, it is recommended to deepen the characterization of these priorities and further enrich the strategic thematic priorities, and in particular to further explore untapped and niche emerging sectors.

3. **BIOECONOMY CLUSTERS: Stimulate the emergence of bioeconomy clusters at national & regional levels**

Despite the existence of several bioeconomy clusters, there is a significant margin for scaling them up in CEEC countries, so that they could irrigate the national but also regional & place-based bioeconomy ecosystems. It is important these Clusters are in capacity to operate not only as Research intermediaries but also as Community animators and as Business & Innovation accelerators, notably through joint investment/innovation projects catalyst and support mechanism.

4. **BBM NETWORK: Initiate and animate a dedicated network of Bioeconomy & BBM community of stakeholders**

As indicated by the mapping exercise, there is a growing number of players active as entrepreneurs, innovators, early-stage investors, and project holders in various areas of bioeconomy and BBM. It would be more than welcome to organize a networking platform of BIOECO/BBM stakeholders, with a Business development & tech-transfer spirit, embarking start-ups, spin-offs, VCs, BioEast countries' diasporas, and other change makers (NB: The leading European Clusters in the field – IAR, in France - has renamed its brand as “Bioeconomy for Change”)

5. **DEMO & USE-CASES: Develop a repository/library of demo- and use-cases demonstrating the value-added and diversity of BBM new developments**

Mutual learning and benchmarking are always key-steps on the pathway to improvement. Especially when the knowledge is focused on practical transferable patterns: demo-cases, use-cases, business cases. Especially when the focus is made on economic modelling and end-users experience. It is recommended to elaborate a dynamic mapping of BBM-relevant initiatives, businesses and investment projects in the BIOEAST countries, and to benchmark them with comparable and champions models identified elsewhere in the EU and Associated countries.

6. DEMONSTRATORS' INFRASTRUCTURE: Concentrate resources on the scaling-up of bioeconomy technology demonstrators for priority & emerging value-chains

Due to limitations observed in the Bioeconomy-related technology development infrastructure in the BIOEAST countries, including weaknesses in the equipment made available by academia, it is recommended to prioritize the concentration of resources on the scaling-up of state-of-the-art infrastructure, which could serve technology and business development of flagship BBM projects. It is recommended to build a partnership which could set-up & fund a unique networked/decentralized demonstration & services infrastructure to support circular economy innovations and new investments by industrial users in the BBM segment. It would act as a specialized multi-site hub demonstrating advanced integrated innovation solutions and pilot-plants for bio-based materials across a selected range of fields of applications and technology areas. This public/private facility could deploy open innovation test-beds approaches on selected value-chains and segments.

7. JOIN EU-PARTNERSHIPS: Increase your stakeholders' presence across all existing relevant EU Partnerships and Platforms

Apply for existing TSSPs and to upcoming I3 calls, by better connecting with thematic leading Regions and RTOs; be present in the governance and networking activities of the most significant Partnerships (CBE, EIT Food, ...) and European Associations (BIC, ...); activate Bio-East countries' clusters participation to COSME calls & projects; survey & watch with a particular attention relevant calls and initiatives linked to Cluster 6 of HE, in particular these with a Circular Economy earmarking.

8. DEDICATED BBM PARTNERSHIP: Initiate or contribute to a dedicated European partnership on bio-based chemicals and material

Considering that – apart from the CBE European partnership – there are no really dedicated and specific-enough Partnerships on Bio-Based Materials, it is recommended to initiate or join an EU-level collaborative influencing effort aiming to convince the EU and MS to implement one of this kind, and to crystallize the specific constraints & assets of the BIOEAST countries on the matter.

9. BIO-BASED MANUFACTURING ACADEMY: Create a joint Partnership with higher Education Institutions, Technical Universities & Specialized Vocational Training bodies to offer a multi-site Curriculum addressing gaps in the skills 'map, especially as far as specific advanced manufacturing techniques & processes, in partnership with industrial champions.

10. UPLIFT THE BIOEAST PROFILE: Develop a true "corporate & branding" communication policy with the aim to attract attention of Bioeconomy champions on the BIOEAST brand, which could become a qualification label for policies, projects, intermediaries and businesses.

11. BUILD A BIOEAST POLICY COALITION FOR EU ADVOCACY :

a) **RESPOND TO CAP STRATEGIC PLANS' EC/MS INTERACTIONS:** There is an opportunity to address enhanced specific requests to the EC-DG AGRI as a follow-up of the Observation Letters sent by the EC on 31 March 2022 to most of the BIOEAST countries, especially as far as "Investment for economic sustainability" is concerned. Many MS indeed planned to support rural businesses addressing economic objectives, including financial support for on-farm investments for processing and marketing and development of agricultural products. Agricultural products are bio-based products !

- b) Despite of the fact the new CAP regulations have been legally adopted (6 December 2021), there might be an opportunity to influence the secondary legislation (in progress during year 2022), being itself possibly influenced by the bilateral discussions about national CAP Strategic Plans and to what extent specific matters could be taken on-board.
- c) **APPROACH EC-DG REGIO AND ERDF MANAGING AUTHORITIES**, calling for attention for investment and structural support to Bio-Based Materials (BBM) value chains through Structural Funds. In parallel to this, calling DG RTD to consider a BBM specific Partnership has already been mentioned above (Recommendation # H) might be useful, as well as calling for the specificities of EU-13 MS, in convergence with the widening principle.
- d) **DEVELOP AN ADVOCACY PACKAGE HIGHLIGHTING THE ROLE OF BIOECONOMY (AND BBM) TOWARDS THE GREEN DEAL**, through the prevention and valorisation of agri-food wastes, circular biomass valorisation, innovative packaging, nutrients recycling, biobased fertilizers,...
- e) **PROVIDE A STRATEGIC WATCH & JOINT SUPPORT TO BIOEAST PROJECTS' PROPOSERS TARGETING HORIZON EUROPE & CBE CALLS:** develop this through an EU-funded platform (A CSA for example) operated by a consortium of agents representing the BIOEAST countries.

11. Reference

1. EU Biorefinery Outlook to 2030, EC-DG RTD, Feb. 2021
2. Deploying the Bioeconomy in the EU: A framework approach for bioeconomy strategy development, EC-DG RTD, 2021
3. Biomass in the EU Green Deal, IEEP (Institute of EU Environmental Policy), 2021
4. Circular Bio-Based Europe SRIA, 2021
5. The Green Deal and the CAP: policy implications to adapt farming practices and to preserve the EU's natural resources, EP-AGRI Committee, Nov. 2020
6. State of play of CEEC Bioeconomies, NOVA Institute/CASA, Nov. 2018
7. Bioeconomy development in EU regions, EC-DG RTD, Sweco, Feb. 2017

