# 7th European Bioplastics Research Network Event

## Projects2Policy: Aligning outcomes from EU projects with the EU policy for bio-based and biodegradable plastics

*23rd November 2022, 10-12h CET*

*Outcomes from 49 projects collected within GLAUKOS & BIO-PLASTICS EUROPE online workshop held on 3rd November from 9-12h CET*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement BIOPLASTICS EUROPE No. 860407.

This project has received funding from the Bio-based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887711. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio-based Industries Consortium.

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# 1. Introduction

The collaboration between the GLAUKOS project, BIO-PLASTICS EUROPE project, European Bioplastics Research Network (EBRN) and the European Bioeconomy Network (EuBioNet). (EuBioNet) led to the organisation of:

- WORKSHOP: "Unlock the potential of bio-based and biodegradable plastics: challenges to be addressed", held online on 3rd November 2022 from 09:00-12:00 (CET).
- 7th EBRN EVENT: "Aligning outcomes from EU projects with the EU policy for bio-based and biodegradable plastics" that will take place online on 23rd November 2022 from 10:00-12:00 (CET) where the outcomes of the previous workshop will be used to engage in the discussion between projects and policy officers.

These events already build on previous cooperation activities like:

- Glaukos Stakeholder Labs workshop "Tackling microplastics pollution: can biodegradable textile and coating be a solution?"– 20th June 2022. Report available here.
- 6th EBRN EVENT "Insights from 10 Horizon projects: EU policy for bio-based and biodegradable plastics" – 22nd June 2022.
- Shared online document collecting Questions & Answers from Policy Officers and Projects with regards to important policy and research questions

# 2. Projects that join the workshop

In total 89 participants from 34 different countries (of which 21 European) joined the workshop entitled "Unlock the potential of bio-based and biodegradable plastics: challenges to be addressed" representing 49 different projects.



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In the following the registered projects and the number of members representing each project is described: Glaukos (12), BIO-PLASTICS EUROPE (10), Alchemia-Nova (3), SUSTRACK (3), BIOGEARS (2), Biovoices (2), Genb (2), HARMONITOR (2), HEREWEAR (2), LABPLAS_Project (2), NENU2PHAR (2), PRESERVE (2), Redondo (2), REPurpose (2), SEALIVE(2), SMARTBOX (2), STAR4BBS (2), SURPASS (2), Transition2bio (2), UpLift (2), AURORA (1), BIObec (1), Biobridges (1),BIOMAC (1), Biotransform (1), CATCO2NVERS (1), CHAMPION Project (1), CUSP (1), DIVAGRI (1), European Bioecomy Network (1), FEDKITO (1), AURORA (1), IMPTOX (1), iMULCH (1), INNPRESSME (1), Lift (1), Miplace (1), MIX-UP (1), Nenu2PH (1), NOOSA (1), PHA Based Formulations (1), PlasticHeal (1), PlastX (1), POLYRISK PLASTICSFATE (1), REMEDIES (1), ShapingBio (1), SOPLAS (1), STAR-ProBio (1), Usable Packaging (1).

*Nearly 80% of the participating projects actively contributed to the workshop, and those were clustered around main topics represented below.*



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*This diversity, but yet synergy, to contribute to the EU policies, especially EU plastic strategy, allows to identify important conclusions in order to upgrade new EU project calls, as well as contribution from the projects to the EU policies.*

# 3. The workshop

*The objective of the workshop was to involve the most relevant projects related to bio-based plastics, to discuss the most urgent challenges to be addressed to unlock the potential of bio-based and biodegradable plastic, in light of providing policy recommendations to be shared with EC Policy Officers in the context of the upcoming 7th EBRN Event (23rd November 2022).*

The open discussion was structured along the following four macro topics, which were again divided into four discussion topics (see figure):

- System perspective: LCA of bio-based vs conventional plastics
- End-of-Life options (biodegradability, ecotoxicity, recyclability, leakage, etc.)
- Raising awareness, stakeholder engagement, collaboration and coordination
- Projects' contributions to EU policies



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The participant's interest towards the discussion topics was collected during the registration:


*As identified in this quick pool (figure above),* ***interest of the projects to contribute to the EU policies was just slightly over 50%.*** This result is worrying, considering the importance of the topic. Therefore, it is something that should be addressed in the future, by providing clear guidance from the EU to the projects why this is important and how to establish stronger links between projects and the EU Policies.

The workshop´s discussion was supported by a dedicated MIRO board, where the participants could contribute by adding sticky notes with their comment's inputs.



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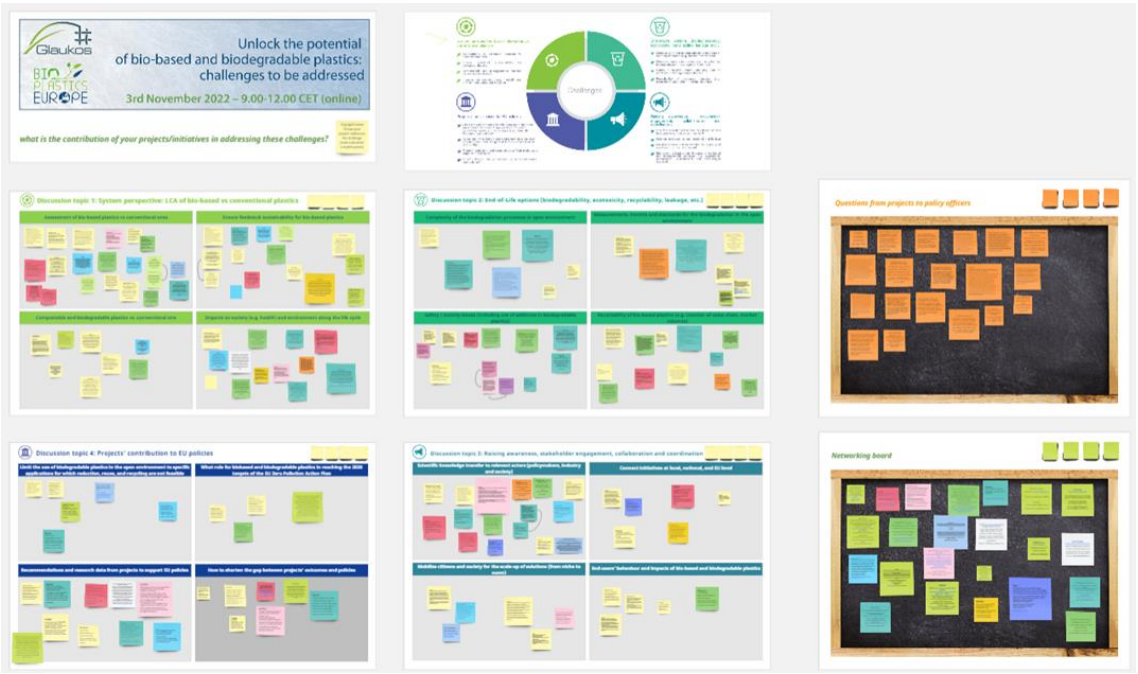


# 4. Outputs of the workshop

The main achievement of the workshop was the mapping of 49 projects' objectives, outcomes, gaps and recommendations against the 4 discussion topics identified as relevant by the Policy officers and elaborated during the preparation of the workshop.

**This format (Projects2Policy) can be replicated in different domain to shorten the gap between projects and policies, by facilitating the exploitation of Actionable Knowledge for policies, generated by EU funded projects.**

The following paragraphs report the main outcomes per each 4 discussion topics, stemming from more than **220 contributions** from the projects participating.

## 4.1. Discussion topic 1: System perspective: LCA of bio-based vs conventional plastics

This discussion topic was divided into 4 subtopics:

1. Assessment of bio-based plastics vs conventional ones
2. Ensure feedstock sustainability for bio-based plastics
3. Compostable and biodegradable plastics vs. conventional ones
4. Impacts on society and environment along the life cycle

Within this discussion topic 22 projects contributed with ideas.

The organisers of the workshop stated that a comprehensive environmental Life Cycle Assessment of the new solutions needs to be compared with conventional alternative solutions, taking into account the bio-based nature of the materials and biodegradability



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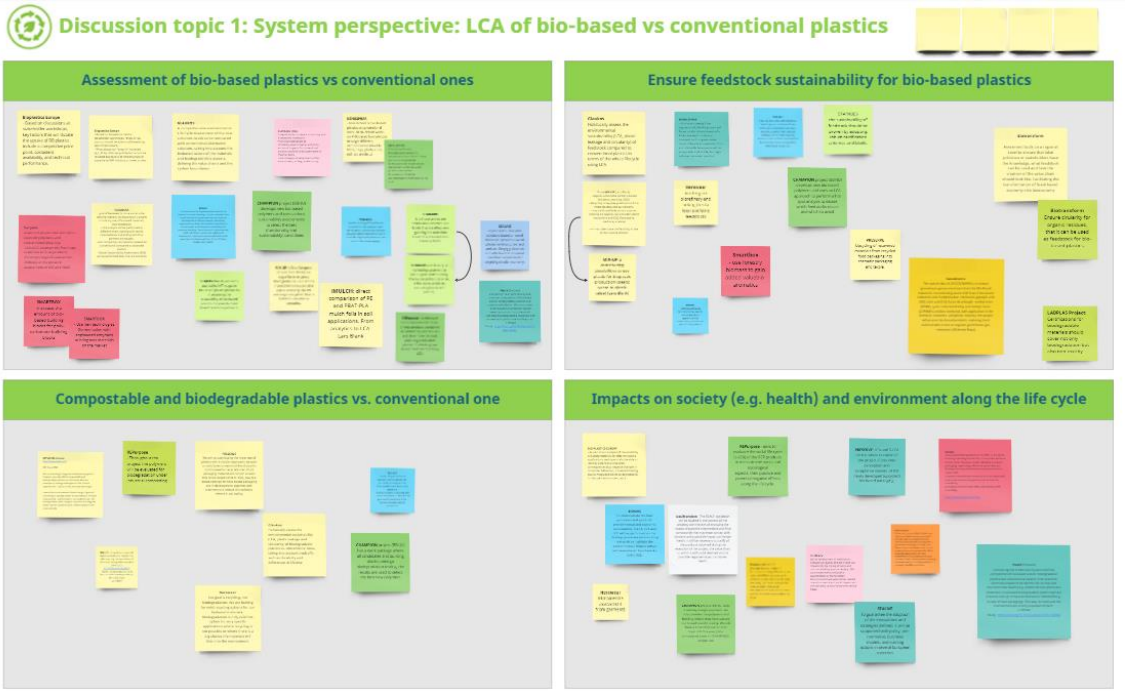
aspects, defining the value chains and the system boundaries. In the image below, visualisation of the board is available.




## Key outputs identified from the projects

| Subtopics | Main takeaway |
|---|---|
| Assessment of bio-based plastics vs conventional ones | • Bio-based materials offer one unique advantage: they help to reduce the dependency on finite fossil resources, to reduce greenhouse gas emissions and energy consumption, and therefore to reduce a product's overall carbon footprint.<br>• Key factors that influence uptake of BB plastics: competitive price, consistent availability, technical performance<br>• Existing problem remains lack of infrastructure (e.g. recycling plants for BB plastics)<br>• Further research gaps exist in the areas of comparison of Life Cycle Assessment of conventional and BB plastics, various fields of application, cradle-to-grave assessment methodology<br>• Developed a tool, called IAT, to guide bio-based plastic producers in assessing the sustainability of bio-based plastics compare to fossil-based reference products<br>• To measure the environmental impact of new products compared to commercial alternatives and determine the most polluting production phases |
| Ensure feedstock sustainability for bio-based plastics | • Sustainability should be proven by robust certification schemes and labels (not only biodegradability but also non-toxicity)<br>• Holistically assess the environmental sustainability (LCA, plastic leakage and circularity) of feedstock compared to conventional plastics in terms of the whole lifecycle using LCA |



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|---|---|
| | • Assessment tools on a regional Level to ensure that local politician or stakeholders have the knowledge, what feedstock can be used and how the creation of the value chain should look like<br>• Ensure circularity for organic residues, that it can be used as feedstock for bio-based plastics<br>• Start with available carbon sources (cooking oil, sugars), but consider plastic monomers and CO2 |
| Compostable and biodegradable plastics vs conventional one | • Holistically assess the environmental sustainability (LCA, plastic leakage and circularity) of biodegradable plastics vs. conventional ones, taking into account trade-offs such as durability and differences in lifetime<br>• Biodegradable plastics are made for ending up in the environment. Therefore, for these materials it is especially important that they do not contain toxic chemicals.<br>• The world of plastics (ie. their origins, classification and properties) is a complex one, if not directly gibberish, for non-experts and the general public. Therefore, the effort to make it accessible to all audiences must be maintained over time and its effectiveness regularly checked /assessed.<br>• Certifications for biodegradable materials should cover not only biodegradation but also non-toxicity<br>• New bio-based coatings for fibre-based packaging are in development, together with treatments to reduce microplastics release in packaging<br>• As with conventional plastics, the manner in which bioplastics waste is actually recovered depends on the type of product and bioplastics material used, the inherent quantities and the recovery systems available.<br>• The overwhelming part of the bioplastic volume produced today can easily be recycled alongside their conventional counterparts where separate recycling streams for certain material types exist (e.g. biobased PE in the PE-stream or biobased PET in the PET-stream). This way, bioplastics contribute to higher recycling quotas in the EU and the implementation of the circular economy. |
| Impacts on society and environment along the life cycle | • Identification of potential unintended intermediate and final consequences by studies<br>• To reduce a product's resource use and emissions to the environment and improve its social and socio-economic performance throughout its life cycle<br>• Assessment of different materials (e.g. microplastics)<br>• To guarantee the adoption of the innovations and strategies defined, it will be supported with policy, pre-normative, business models, and training actions in several European countries<br>• Consider the chemicals used in the materials and present in the final articles and their toxicity. Make sure that materials are not only sustainable but also safe for humans and the environment at all stages of a product's life cycle. |



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All project outcomes collected within discussion topic 1 are available in **Annex 1** at the end of the document.

## 4.2. Discussion topic 2: End-of-Life options (biodegradability, ecotoxicity, recyclability, leakage etc.)

In the second discussion topic the following subtopics were identified:

1. Complexity of the biodegradation process in open environment
2. Measurements, metrics and standards for the biodegradation in the open environment
3. Safety/ toxicity issues (including use of additives in biodegradable plastics)
4. Recyclability of bio-based plastics

Within the second discussion topic 17 projects contributed with inputs.

From the discussion based on the inputs from the project, it resulted that better understanding of safety and ecotoxicity of the compounds resulting from the degradation of biodegradable materials is needed. Furthermore, the need for tools to overcome the challenges of ensuring both good durability and biodegradability of the materials was identified.


### Key outputs identified from the projects



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| Subtopics | Main takeaway |
|---|---|
| Complexity of the biodegradation processes in open environment | • It is important to decide when biodegradation is desirable and duration of the period before the material starts degradation. The solutions should be simple and easy to understand.<br>• Projects study evaluation of biodegradation in different environments: industrial composting, anaerobic conditions, soil, fresh water, marine conditions<br>• Standards intended to investigate the biodegradability of a given polymeric material must consider that there will be different conditions affecting biodegradation rates<br>• Visualisation of complexity of biodegradation for society important, e.g. https://bioplasticseurope.eu/facemasks,"https://bioplasticseurope.eu/facemasks" |
| Measurements, metrics and standards for the biodegradation in the open environment | • Finding the perfect solution for the development of standards is hampering, a one size fits all standards is not fitting due to level of variation in different environment<br>• Unintended/accidental/criminal release into the environment makes the discussion about standards even more complicated<br>• Currently available methods for assessment of biodegradability of plastics are frequently unpractical, lack in ecological perspective and are insufficiently standardized<br>• Methods to assess the biodegradability of plastics, particularly in marine environments, and at the micro-scale, are still insufficiently standardized<br>• Write Recommendations about the need of the standard biodegradation testing procedure modifications based on the gaps found. |
| Safety/toxicity issues | • Safety of BB/BD plastics including additives should at least meet the expectations placed on traditional plastics (if not exceeded)<br>• Additives should be tracked (inventory)<br>• Assessment of release and exposure of IAS and NIAS final products<br>• Avoiding any potentially hazardous chemicals<br>• Assessment of occupational exposure should be performed<br>• Definition and implementation of suitable Safe-by-Design strategies should be further developed |
| Recyclability of bio-based plastics | • Production of new materials to be recyclable-by-design<br>• Improvement of current sorting technologies and procedures e.g NIR technologies to sort biobased plastics with 99.9% accuracy<br>• Many projects identified that recyclability has better potential than focusing on biodegradation of BB plastics |

All project outcomes collected within discussion topic 2 are available in **Annex 2** at the end of the document.



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## 4.3. Discussion topic 3: Raising awareness, stakeholder engagement, collaboration and coordination

In the third discussion topic the following subtopics are enclosed:

1. Scientific knowledge transfer to relevant actors
2. Connect initiatives at local, national, and EU level
3. Mobilize citizens and society for the scale-up of solutions
4. End-users' behaviour and impacts of bio-based and biodegradable plastics

In this section, 18 projects showed their interest and contributed with discussion ideas.

The organizers in collaboration with the project representatives indicated that a deep understanding of the scientific facts involved, such as LCA and end-of life options, a takeaway must be passed on the society and end users. Only the combination of these two factors can guarantee a mindful utilization of bio-based materials.

The communication must be transparent, comprehensive, and clear. To reach out, educate, inform, and inspire the end users, specific tools must be identified. These tools must be in accordance with the interests of the target audience.


### Key outputs identified from the projects

| Subtopics | Main takeaway |
|---|---|
| Scientific knowledge transfer to relevant actors | • Provide independent, science-based, and balanced information and tools that are accessible and understandable for stakeholder outside research<br>• Organise multistakeholder debates and workshops at EU and national level, in order to exchange knowledge, create |



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| | collaborations, communicate and disseminate the scientific results<br>• Implementation of scientific and practical results of projects in the educational process of higher educational institutions to disseminate the latest information and increase the awareness of young people, accordingly increasing the number of conscious consumers.<br>• Involvement of students in specific initiatives to raise the awareness of ordinary consumers about the responsible use of bioplastics.<br>• Facilitate networking and collaborations among projects and initiatives to jointly address common challenges and promote the circulation of EU funded research<br>• Transform the scientific outcomes into actionable knowledge stemming from the projects' activities, also in form of aggregated results, in order to maximise their exploitation and impacts and provide recommendations for policy and industry<br>• Case studies and sustainable business models should be used to communicate the benefits of the transition and inspire similar domains<br>• Promote stakeholder empowerment and facilitate the systemic thinking for the uptake of the bio-based economy |
| Connect initiatives at local, national, and EU level | • Organise workshops with relevant actors over value chain to lower the collaboration barriers, identify gaps to be addressed and co-create shared and acceptable solutions<br>• Promote the awareness of good practices and facilitate the transfer and replicability to regions having similar characteristics<br>• Create assessment tools and capacity building activities on EU and regional level to ensure that local politicians or stakeholders have the knowledge and skills<br>• Provide inspirational insights for future projects and initiatives connecting EU-funded research with the local, national, and EU beneficiaries |
| Mobilize citizens and society for the scale-up of solutions | • Provide a framework by which to map and organize bioeconomy communication activities, thereby targeting stakeholders with different levels of maturity with regard to awareness of and engagement with the bioeconomy (from raise awareness to behavioural change)<br>• Promote transparent communication on composition of materials (e.g. Sustainable Product Initiative and Digital Product Passport development), production processes, purchase and usage sustainable behaviours and end-of-life options |



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| | • Involve the stakeholders in co-creation processes to design inclusive platforms, not only for knowledge exchange, but also to promote "sustainable citizenship"<br>• Keep on supporting awareness raising activities targeting the large public (e.g citizen science exhibition and engagement, researchers' nights, R&I days, etc.) |
| End-users' behaviour and impacts of bio-based and biodegradable plastics | • Key elements like motivational drivers (economic, social, environmental) and barriers (misconceptions, resistances, behaviours) should be considered in the design of effective policies and actions supporting the transition<br>• Provide education and information to address (low) levels of knowledge, awareness and (unrealistic) expectations of consumers concerning bio-based and biodegradable plastics (including correct use and end of life)<br>• Also the awareness and education of end users like fishermen are key for the sustainable uptake of bio-based and biodegradable solutions<br>• Dissemination of information to end consumers through special promotions in cooperation with large companies on the market that use recycled plastic or bioplastic<br>• Provide only the necessary information avoiding overwhelming the consumers with messages<br>• Define clear labelling to support responsible behaviours from end-users and consumers and minimize the risk of negative impacts derived by lack of information and misusage<br>• Keep on assessing and monitoring the consumers' perception and acceptance of bio-based and biodegradable plastics |

All project outcomes collected within discussion topic 3 are available in **Annex 3** at the end of the document.

## 4.4. Discussion topic 4: Projects' contributions to EU policies

In the last discussion topic, the following subtopics are elaborated:

1. Limiting the use of biodegradable plastics in the open environment to specific applications
2. The role for bio-based and biodegradable plastics in reaching the 2030 targets of the EU Zero Pollution Action Plan
3. How to shorten the gap between projects' outcomes and policies
4. Recommendation and research data from projects to support EU policies

In total 14 projects contributed actively with inputs to this discussion topic.



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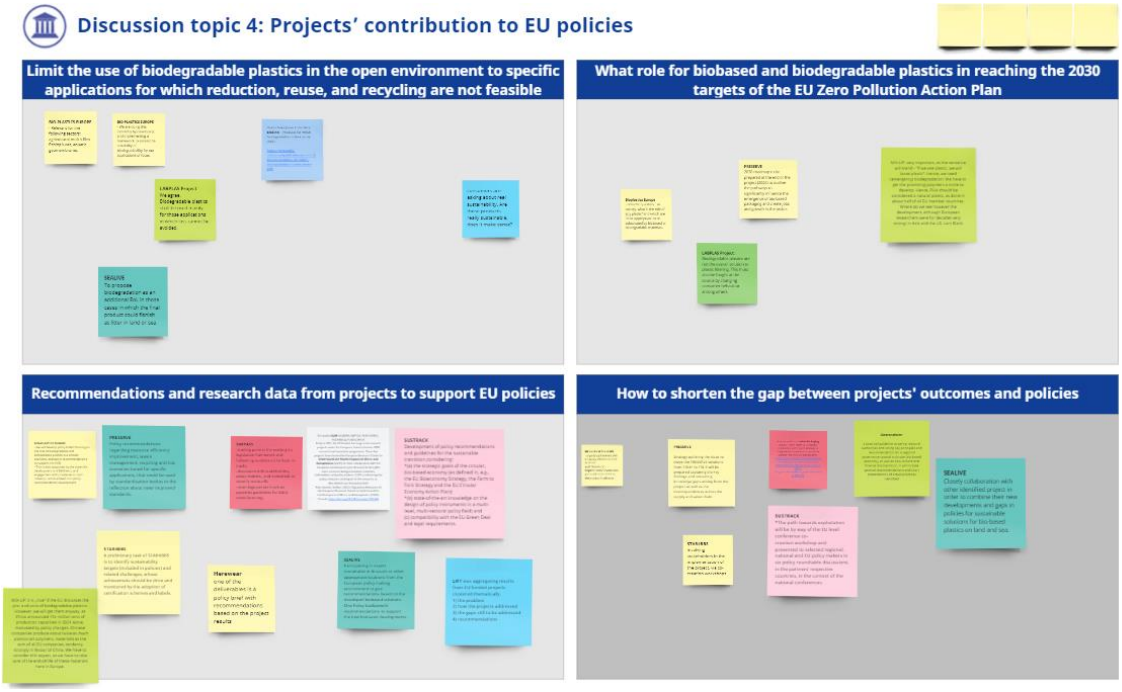
***This is interesting finding, since only 25 projects were interested to this topic (little over 50%), but finally only 14 projects contributed to this discussion (less than 30%).***

The outcomes of the discussion concluded that a cross-functional collaboration has to be established between stakeholders, project leaders and EU policy officers. This cross-functional collaboration must be based on open communication between the parties. To facilitate the implementation of an action plan which leads towards achieving the key 2030 targets to reduce pollution at source, the main findings must be presented in a simple, and easily applicable way.




## Key outputs identified from the projects

| Subtopics | Main takeaway |
|---|---|
| Limit the use of biodegradable plastics in the open environment to specific applications for which reduction, reuse, and recycling are not feasible | • Most relevant for sectors like agricultural mulch film, fishing lures, aquatic geomembranes<br>• Projects are providing suggestions about products that should be biodegradable, but synergies between projects is needed<br>• Development and implementation of framework to assess the sustainability of biodegradability<br>• Biodegradable plastics shall be used mainly for those applications in which loss con not be avoided<br>• Questions of "real sustainability" |
| What role for bio-based and biodegradable plastics in reaching | • "If we use plastic, we will lose plastic"<br>• Biodegradable plastics are not the overall solution to plastic littering. This must also be fought at the source by changing consumer behaviour among others. |



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| the 2030 targets of the EU Zero Pollution Action Plan | • Promising polymers have to get a niche to develop<br>• Need for (emergency) biodegradation<br>• Outline the pathways to significantly influence the emergence of bio-based packaging and create jobs and growth in the sector |
| Recommendations and research data from projects to support EU policies | • Policy recommendations regarding resource efficiency improvement, waste management, recycling and EoL scenarios tuned for specific applications, that could be used by standardization bodies in the reflection about new/ improved standards.<br>• In future proposals one of the deliverables must be a policy brief with recommendations based on the project results<br>• Align EU policies with international ones (think about end-of-life in Europe)<br>• Development of policy recommendations based on project developments and final results, and tying it up with the Green Deal and Circular economy Action Plan, meeting research, science, and practice with policy-making<br>• Clustering with other projects to identity gaps challenges, common issues, common opportunities and work together |
| How to shorten the gap between projects' outcomes and policies | • Events to get in contact and discuss about relevant topics<br>• Closely collaboration with other identified project in order to combine their new developments and gaps in policies for sustainable solutions for bio-based plastics on land and sea.<br>• The path towards exploitation will be by way of the EU level conference co-creation workshop and presented to selected regional, national and EU policy makers in six policy roundtable discussions in the partners' respective countries, in the context of the national conferences. |

All project outcomes collected within discussion topic 4 are available in **Annex 4** at the end of the document.

# 5. Recommendations for future steps

- Increase the **opportunities of mutual learning, knowledge exchange and clustering**
- **Shorten the gap among projects and policies**, e.g., creating **Projects2Policies Think Tanks**. *This could be a topic for a future CSAs*
- Facilitate **thematic discussions** involving projects (and stakeholders) with similar objectives



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- **Empower policymakers with Actionable Knowledge**, stemming from projects, ready to be used in their practice
- Promote the **cross fertilization with other programmes**, like Interreg, EIT raw materials, Erasmus+, LIFE, ecc. To increase exploitation and impact

# 6. Questions from the projects

## Questions from the Event 22nd June 2022

? How to make sure that also bio-degradable or "green" plastics do not cause any harm to humans (e.g., at workplaces, such as exposure to PLA particles from FFF 3D printing) or the environment along their life cycle?

? How to sustainably and safely handle and regulate the vast amount of plastics that already occurs especially as MNP in the environment considering the long period involved?

? What is the Commission's reaction to the recent Material Economics report concluding that plastics recycling in Europe is at a much lower rate than previously thought? If true would this have implications for the timing of targets, thinking about the role of plastics more strategically, control of leakage to the environment, etc?

? With reference to the EU Green Deal, several instruments have been noted such as the product passports, extended eco-design, and the safe and sustainable design concept. Are there any intentions or indications that these instruments may be expanded or tailored to cover biobased and biodegradable plastics?

? Also mentioned in the EU Green Deal, is an ambition for the commission to step up its regulatory and non-regulatory efforts to tackle false green claims. With respect to biobased and biodegradable plastics, how are the commission planning on going about this?

? With regards to commercial applications of breakthrough technologies, what role can the bioplastic industry play (and what incentives are available) for them to become the 'climate and resource frontrunners' that the commission has indicated a need for in the Green Deal?

? Since the investigation of the bio-based and biodegradable plastics industry done within the BIO-PLASTICS EUROPE project led to identifying an emerging one-to-one substitution trend among some converters, a



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clarification about the criteria used by the Commission to identify the relevant applications where these materials can effectively add value compared with their fossil-based counterpart. Additionally, we found increasing use of 100% bio-based and biodegradable plastics in durable goods (rigid packaging, toys, etc.). Therefore, there is an issue concerning the relationship between biodegradability and durability. Is the Commission intended to invest in biodegradable and durable goods?

? Although circularity is a system property, the fragmentation of waste governance, the lack of dedicated waste management, or still, the lack of information about the waste infrastructure facilitating the valorization of compostable plastics make the validation of circular strategies challenging. A comprehensive description of each European country's existing waste management system is crucial to understanding the value retention potential.

? Due to the limits of the European projects concerning time (most cases of four years), apart from alternatives such as workshop agreement, what could be possible options for the standardization of a novel biological recycling plastic alternative within the limits of the project?

? What should or will be the strategies of the competent European organisms to adapt the existing legislative/regulatory framework to the new options for chemical recycling in general and biological recycling in particular?

## QUESTIONS FROM THE WORKSHOP 3rd November 2022

? How to better acknowledge the technical advancements both in the production, sorting, and end of life options for bio-based, biodegradable, and compostable polymers in the "recyclable packaging" definition?

? CHAMPION project, HARMONITOR project: co-regulation (e.g. the use of voluntary certification in biofuel sustainability): are there concrete areas where you are considering co-regulation, and what inputs do you need?

? Smartbox: Polymer technology to develop novel biomaterials is definitely promising, but therefore sufficient bio-based building blocks should be available. Once the polymer product should go to the market, we need to be assured there is enough raw material, and at this point this cannot be assured yet, which can act as bottleneck in setting steps further with a high potential polymer product.; Biomass availability, legislation; Capex-intensive development and industrialisation; the most difficult things are a) to coordinate a whole value chain and extrapolate it to other similar ones for other products/processes b) To have access to market information in



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order to accurately evaluate if the final products are of commercial interests. (That is, to improve industry-research communication).

? To effectively tackle challenges related to packaging and to mitigate climate change risks, do you think recycling and re-use will be enough? How high is the consideration of the choice of switching to biodegradable, bio-based and compostable plastics, which have proven environmental benefits and contribute to climate change mitigation, while reducing our dependency on fossil fuels for plastics production?

? How to facilitate the adoption of the recommendations from the projects to policies?

? Herewear: Bringing back production to Europe will need support from the EC (eg financial incentives, penalisation) Support in set-up of local value chains, able to provide the necessary materials in sufficient amounts

? EU calls often requires involvement of standardization bodies in proposals, however when we are reaching out to them most of the time, they are not willing to participate - how they could be really involved in projects? (Zsofia Kadar)

? How to facilitate collaboration and mutual learning among projects? Why are CSAs rarely funded to support this (like the European Bioeconomy Network - EuBioNet)?



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# 7. Annexes

The following annexes list all the contributions collected in the MIRO board during the workshop.

## 7.1. ANNEX 1: Results of the 1st discussion topic: System perspective: LCA of bio-based vs conventional plastics

### *Subtopic "Assessment of bio-based plastics vs conventional ones"*

**BIO-PLASTICS EUROPE** -Based on discussions at stakeholder workshops, key factors that will dictate the uptake of BB plastics include a competitive price point, consistent availability, and technical performance.

-Based on discussions held at stakeholder workshops, "drop in" BB plastics should be able to utilise existing WM infrastructure. -What about non "drop-in" materials (e.g., PLA), often recyclable but cannot be recycled due to lack of infrastructure or appetite by WM industry to invest in new.

**GLAUKOS** -A comprehensive environmental Life Cycle Assessment of the new solutions needs to be compared with conventional alternative solutions, taking into account the biobased nature of the materials and biodegradability aspects, defining the value chains and the system boundaries.

**NENU2PHAR** -Assessment of bio-based plastics vs conventional ones. NENU2PHAR works on PHA based formulations to target different demonstrators (flexible films, trays, plastic cups, roll-on, textile,...)

-Compostable and biodegradable plastic vs. conventional one. NENU2PHAR works on compostable formulations for food contact applications and recyclable products for other formulations. A whole work package is dedicated to this topic

**SUSTRACK (CSA)** *-overall aim is to create a monitoring and assessment framework *life cycle assessment of circularity, environmental and socio-economic impacts for conventional plastics, economy-wide assessment of material flows, national/regional assessment of the environment, society, and economy

**CHAMPION** project (BBI-JU) -develops new bio-based polymers and uses various sustainability assessments to select the best (functionality and sustainability) candidates

**BIOMAC** -To stimulate further implementation towards the direction of circular economy a circular overview of the value chain will be undertaken that will allow the development of efficient networks identifying opportunities to foster the transition from linear to circular model evaluating the sustainability and economic feasibility. These means of assessment will confirm the future commercial viability and improvement conveying environmental and circular sourcing in consistency with the Green EU Policy. (PoliMi, AXIA, UNIPD)



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**HEREWEAR** -goal of Herewear is a more sustainable clothing industry, by focusing on 3 pillars: circularity, use of biobased materials, local production - LCA analysis will be performed at different levels, starting with textile intermediates and ending with final garment prototypes - also investigating microfibre release for conventional compared to biobased textiles - Global Sustainability Assessment (GSA) will be performed after the LCA and sLCA

**STAR4BBS** -It is important to use certification schemes and labels that are effectively guiding the transition towards sustainable bio-based products.

-will develop a monitoring system that will support understanding the sustainability outcomes of bio-bases products (including bio-based plastics).

**PRESERVE**-Benchmarking of fossil-based products in comparison with developed solutions to achieve equal or better performances in shelf life of packed products and end of life of packaging.

**Surpass** -expected project outcome (bio-sourced polymers and conventional plastics): -LCA/LCC assessment from raw materials to final products -Ecotoxicological assessment -Release and exposure assessment of IAS and NIAS

**SEALIVE** -Implement sustainable solutions based on novel biobased plastics to avoid plastics ending-up on land and sea. Recyig-y-deechas and effective EoL solutions have been implemented targeting circular economy.

**MIX-UP** (a Sino-European project, Lars Blank) -we argue for emergency biodegradation, as it seems impossible in a sustainable plastic economy that we use single use plastic that is stable for decades or centuries.

**STAR-ProBio** -developed a tool, called IAT, to guide bio-based plastic producers in assessing the sustainability of bio-based plastics compare to fossil-based reference products.

**PlastX** (finished) -Comparing the in vitro toxicity and chemical composition of bio-based and/or biodegradable plastics and conventional plastics. Main outcomes: - Most bioplastics and plant-based materials contain toxic chemicals - Bio-based/biodegradable materials and conventional plastics are similarly toxic. Whole Study: https://doi.org/10.1016/j.envint.2020.106066

**iMULCH** -direct comparison of PE and PBAT-PLA mulch foils in soil applications. From analytics to LCA. Lars Blank

**SMARTBOX** -increase the amount of bio-based building blocks for polly-carbonate building blocks

- Use new technologies (fermentation with engineered enzymes) to bring new materials on the market

**REPurpose** -to measure the environmental impact of new products compared to commercial alternatives and determine the most polluting production phases. Cradle-to-grave assessment methodology, LCA.



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### *Subtopic "Ensure feedstock sustainability for bio-based plastics*"

**STAR4BBS** -the sustainability of feedstock should be proven by adopting robust certification schemes and labels.

**SEALIVE** -New feasible and optimized bio-based plastic solutions from different sustainable biomass sources (starch from aquatic biomass, PHA from organic wastes and PLA from sustainable feedstocks not in competition with food resources)

**GLAUKOS** -Holistically assess the environmental sustainability (LCA, plastic leakage and circularity) of feedstock compared to conventional plastics in terms of the whole lifecycle using LCA

**NENU2PHAR** -PHA arec coming from alguae. NENU2PHAR project will focus on the development of a PHAs stream to initiate a competitive European value chain of bioplastic material, from a sustainable bio-source with an acceptable End of Life, for high-volume consumer product.

**Biotransform** -Assessment tools on a regional Level to ensure that local politician or stakeholders have the knowledge, what feedstock can be used and how the creation of the value chain should look like. Facilitating the transformation of fossil-based economy into bioeconomy

-Ensure circularity for organic residues, that it can be used as feedstock for bio-based plastics

**MIX-UP** (Lars Blank) -require sustainable carbon sources (biomass, recycling, CO2). - Recycling is key (see publications from Andre Bardow and co-workers). - start with available carbon sources (cooking oil, sugars), but consider plastic monomers and CO2 (formiate to methane, acetate) → microbes have the flexibility in the carbon source choice!!

-is contributing possibilities to use plastic for bioplastic production (plastic waste to plastic value) (Lars Blank)

**Herewear** - working on biorefinery and linking this to locally available feedstocks

**CHAMPION** project (BBI-JU) -develops new bio-based polymers and uses an LCA approach to perform a hot spot analysis to decide which feedstocks to use and which to avoid

**PRESERVE** -Upcycling of recovered materials from recycled food packaging into cosmetic packaging and textile.

**Smartbox** -use forestry biomass to gain added-valuebio-aromatics

**Catco2nvers** -The overall idea of CATCO2NVERS is to reduce greenhouse gasses emissions from the Bio-Based Industries transforming waste-CO2 from 2 bio-based industries into 5 added-value chemicals: glyoxylic acid (GA), lactic acid (LA), furan dicarboxylic methyl ester (FDME), cyclic carbonated fatty acid methyl esters (CCFAMEs) and bio-methanol, with application in the chemical, cosmetics and plastic industry, the project will process bio-based products replacing fossil material with a zero or negative greenhouse gas emissions. (Alchemia Nova)



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**BIOMAC** -Use lignocellulosic biomass for bio-based nanomaterials in application like construction, automotive, agricultural products

**LABPLAS** Project -Certifications for biodegradable materials should cover not only biodegradation but also non-toxicity.

### *Subtopic "Compostable and biodegradable plastics vs. conventional one"*

**PRESERVE** -We aim at substituting the linear use of plastics with a circular approach: we want to substitute conventional fossil plastics by bio-based or recycled ones. Food packaging material will contain at least 85% of bio-based content. Also, new bio-based coatings for fibre-based packaging are in development, together with treatments to reduce microplastics release in packaging.

**REPurpose** -Throughout the project, the polymers will be evaluated for biodegradation under industrial composting

**SOPLAS** (EU-horizon) https://www.soplas.org/ ESR from WUR -We are intending to degrade conventional polymers. However, we noticed that compostable and biodegradable plastics are also tricky. We have examples of biodegradable plastics that should degrade after 2 years in soils, but they take longer. I would like to recommend a label change. If you sell something as biodegradable, it may end up in the open environment - and the label is not made for that. The biodegradable labels are given to plastics that degrade under specific conditions (that seldom happen in the environment)

**SEALIVE** -The developed biobased solutions will be design for: Reusable, Biodegradable, Compostable and Anaerobic digestion. Also, it has been analysing the current standards to identify the gaps and limitations of the current biodegradation procedures.

**GLAUKOS** -Holistically assess the environmental sustainability (LCA, plastic leakage and circularity) of biodegradable plastics vs. conventional ones, taking into account trade-offs such as durability and differences in lifetime

**CHAMPION** project (BBI-JU) -has a work package where all candidates and building blocks undergo biodegradation testing, the results are used to select the best new polymers

**MIX-U** -to reach a sustainable plastic economy we require very high recycling rates (mechanical, chemical, biological), estimated 75+%) (DOI: 10.1126/science.abg9853) - hence, compostable can only be a niche for certain products, like waste bags Lars Blank

**Herewear** - EoL goal is recycling, not biodegradation. We are looking for valid recycling options for our biobased materials. Biodegradation is only valid EoL option for very specific applications where recycling is not possible or where there is a big chance the materials will litter into the environment.

**BIOGEARS-** EoL goal is to organically recycle biobased and biodegradable aquaculture gears. "Biodegradable" should be explained to end user, as not intended to be biodegradable at sea, but meaning that they are compostable at their end of use (as EoL option). Biodegradable can cause confusion as biobased gears are not intended for littering. Thus, collection and selection



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of biobased aquaculture gears are needed in port facilities and at their end of use and logistics to recycling facilities (mechanical or chemical recycling could be possible, infrastructure availability should be checked site by site).

### *Subtopic "Impacts on society (e.g., health) and environment along the life cycle"*

**BIO-PLASTICS EUROPE** -As part of our analysis of the suitability of biodegradability for different plastic applications, we hope to also be able to identify potential unintended consequences (e.g., negative changes in consumer behaviour, increased littering due to misguided belief on degradability in the open environment, etc.)

**REPurpose** -aims to evaluate the social life cycle (s-LCA) of the REP products to measure the social and sociological aspects, their positive and potential negative effects along the life cycle.

**Surpass** -aims to build SSbD guideline for EU SMEs in the plastic sector by collecting the data for 3 case studies for three sectors of the EUropean market (Building, transport, packaging) representing 70% of the plastic demand. Building: bio-sourced vitrimers for windows frame to replace PVC; transport: novel vitrimer materials for train bodies with enhanced mechanical properties and intrinsic fire retardancy; packaging: multinanolayer (MNL) with ideally 100% recyclability https://www.surpass-project.eu/,"https://www.surpass-project.eu/"

**PRESERVE** -LCA and S-LCA for the whole duration of the project. Consumer perception and acceptance studies of the newly developed (upcycled) bio-based packaging.

**UpLift** project -The REACH legislation will be studied in the context of the project with the aim of analysing the impact of possible intermediate and final compounds that may have contact with humans and a possible impact on human health. It will be necessary to clarify all the products obtained during the execution of the project, the value chain to which it will destined and its possible negative impact on human health.

**BIOMAC** -To demonstrate the final processes and products' environmental and economic sustainability, S-LCA, LCA and LCC will be performed on the develop processes and resulting materials to highlight the environmental impact versus petroleum-based benchmarks. (UBU, ISQ)

**NENU2PHAR** -The main goals of NENU2PHAR are to reduce a product's resource use and emissions to the environment and improve its social and socio-economic performance throughout its life cycle. Demonstration of the economic, social, and environmental sustainability of the proposed approaches and main elements that a business plan should include in order to realise them, including the assessment of possible positive and negative side-effects and risks

**PlastX** (finished) -Comparing the in vitro toxicity and chemical composition of bio-based and/or biodegradable plastics and conventional plastics. One outcome: chemicals known to be harmful for human and environmental health (e.g., endocrine disruptors) are contained in biobased/biodegradable plastics and are prone to end up in the environment or foodstuff (e.g., in case of food packaging). This way, humans and the environment are directly exposed to them.



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WholeStudy: https://doi.org/10.1016/j.envint.2020.106066,

**SUSTRACK** - (a) the development of methods to evaluate soil quality and other land-use impacts; (b) the linking of micro-and macro-modelling approaches (e.g., life cycle assessment); and (c) the quantification of monetisation factors to estimate externalities related to environmental and social impacts and the monetary value of ecosystem service flows.

**GLAUKOS** (WP6-EOL1 biodegradation, UVigo) -If focusing on biodegradation in the natural MARINE environment, climate change and oceans/ seas warming, can be an unexpected new variable (impact on biodegradation rate, for instance and/or the biota responsible for that)

**Herewear** - microplastics assessment from garments

**CHAMPION** -project (BBI-JU) uses a safe-by-design approach: we only consider biopolymers and building blocks that have passed our broad toxicity testing. We will have a short webinar on this topic still this year (date announced soon on CHAMPION-project.eu)

**SEALIVE** -To guarantee the adoption of the innovations and strategies defined, it will be supported with policy, pre-normative, business models, and training actions in several European countries

## 7.2. ANNEX 2: Results of the 2nd discussion topic: End-of-Life options (biodegradability, ecotoxicity, recyclability, leakage etc.)

### *Subtopic: "Complexity of the biodegradation processes in open environment"*

**BIO-PLASTICS EUROPE** -it is important to decide when biodegradation is desirable and the duration of the period before the material starts degradation. The solutions should be simple and easy to understand.

-visualise complexity of the biodegradation, to make it more understandable for society: https://bioplasticseurope.eu/facemasks,"https://bioplasticseurope.eu/facemasks"

**SEALIVE** -Evaluation of biodegradation in different environments (soil, fresh-water, marine conditions) - However, it will also propose control and modulate the lifetime durability in those applications needed.

**REPurpose** -will study biodegradation in specified environments: industrial composting, anaerobic conditions (according to international ISO standards), degradation under marine conditions in case of accidental littering, and under soil conditions, to potentially broaden the application scope.

**LABPLAS** Project -Whereas biodegradability is an inherent property of a given material, dependent on its molecular structure, biodegradation in the natural environment is dependent on other factors that influence microbial activity, including oxygen availability, nutrients (N, P



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and other potentially limiting inorganic nutrients), presence of water, light, temperature, and the composition of the natural consortium of heterotrophic microorganisms present in a given environmental compartment. Therefore, standards intended to investigate the biodegradability of a given polymeric material must consider that there will be different conditions affecting biodegradation rates. By far the hardest condition to be standardized is the composition of the microbial inoculum.

**PRESERVE** -Analysis for biodegradation included using standard, littering also assessed. Enzymatic biodegradation.

**NENU2PHAR** -uses the standard protocols for composability and tests are also in fresh water and sea media. For home composability use of the new French standard NF T51-800 Plastics - Specifications for plastics suitable for home composting (2015). For biodegradation we refer to ISO 14855. We take into account the ecotoxicity after home composting assessment

### *Subtopic: "Measurements, metrics and standards for the biodegradation in the open environment"*

**iMULCH** -Microplastic analytics in the soil still very challenging - Pyrolysis-GC as global means - spectroscopic microscopy after heavy sample preparation for details (Lars Blank)

**BIO-PLASTICS EUROPE** -Discussions held during stakeholder engagement workshop highlighted that often the development of standards can be hampered when trying to find the perfect solution.

-In addition, it is unlikely that a one size fits all standard will be developed as the level of variation in different environments makes this difficult. - A point that is further complicated when we consider intended vs. unintended/accidental/criminal release into the environment.

**SEALIVE** -Implementation of pre-normative studies to foster standardization of biodegradable solution. Elaborate a new standardization work item proposal. Write Recommendations about the need of the standard biodegradation testing procedure modifications based on the gaps found.

**CHAMPION** -This project is developing bio-based, circular, high-performance coatings, adhesives and polymers in home care formulations. Although not plastics directly (either thermosets or water-soluble polymers) there is lots of cross-over with EoL considerations aligning with plastics. One area (and possibly more relevant to Discussion 4) is the potential issues of successful substitution in our project as current targets/definitions/standards for biodegradation are very ambitious. For example, we currently need to aim for >60% biodegradation of in 28 days for aquatic environments, yet we are looking to replace current polymers where degradation won't even reach 20% after 1 year. It indicates a need to consider broadening the targets so that ultimately beneficial new biodegradable polymers can enter the market. (Tom Farmer)

**GLAUKOS** -Methods to assess the biodegradability of plastics, particularly in marine environments, and at the micro-scale, are still insufficiently standardized. - not yet adequate



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methods to use available information on the biodegradability and ecotoxicity of (micro)plastics specifically intended to redirect developments in the textile industry - currently available methods for the assessment of polymer biodegradation in marine environments are frequently unpractical and lack an ecological perspective

-publicly available deliverable entitled “Standardized methods” related to the question of coherent and standardized testing procedures. We also recommend reading the recently published article by López-Ibáñez & Beiras (2022), work financed thanks to the Glaukos project Useful links: Glaukos deliverable on "Standardized methods" Useful links: Glaukos deliverable on "Standardized methods" https://glaukos-project.eu/wp-content/uploads/2022/07/D6.1_GlaukosStandardizedMethod.pdf,"https://glaukos-project.eu/wp-content/uploads/2022/07/D6.1_GlaukosStandardizedMethod.pdf"

Prior knowledge of **UVIGO** (i.e., ECOTOX research team) - “Aquatic toxicity of chemically defined microplastics can be explained by functional additives”. Ricardo Beiras, Eva Verdejo, Pedro Campoy-Lopez, Leticia Vidal-Liñán, Journal of Hazardous Materials, Volume 406, 2021, 124338 (https://doi.org/10.1016/j.jhazmat.2020.124338 ) “Is a compostable plastic biodegradable in the sea? A rapid standard protocol to test mineralization in marine conditions”. Sara López-Ibáñez, Ricardo Beiras, Science of The Total Environment, Volume 831, 2022, 154860, ISSN 0048-9697 (https://doi.org/10.1016/j.scitotenv.2022.154860)

**BIOGEARS-**In sustainability assessment using LCA, negative impacts on marine ecosystems by fossil-based or biobased microplastic release from aquaculture/fisheries gears are still not measurable thus neither comparable. Standard methods to quantify and identify micro-bioplastics are lacking.

### *Subtopic: “Safety / toxicity issues (including use of additives in biodegradable plastics)”*

**PlastX** (finished) One research focus: Comparing the in vitro toxicity and chemical composition of bio-based and/or biodegradable plastics and conventional plastics. Project outcome shows that chemicals known to be harmful for human and environmental health (e.g., endocrine disruptors) are contained in biodegradable plastics and can migrate into the environment . Since biodegradable plastics are made for ending up in the environment, they should not contain toxic chemicals. Whole Study: https://doi.org/10.1016/j.envint.2020.106066

**CHAMPION** -project (BBI-JU) has a work package where all candidates and building blocks undergo biodegradation testing, the results are used to select the best new polymers. We will have a short webinar on this topic still this year (date announced soon on CHAMPION-project.eu)

**REPurpose** -An additives inventory (functionality and toxicity) will be made, prioritising certain compounds for substitution by less harmful counterpart



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**BIO-PLASTICS EUROPE** -the safety of BB/BD plastics including additives should at least meet (if not exceed) the expectations placed on traditional plastic. But we should try not to put additional burden on BB/BD plastics when compared with traditional plastics.

- Based on discussions held during stakeholder workshops - how do we define safety? - how is the safety of BB/BD plastics different from traditional plastics? - while it may be easy to address safety issues for intended uses, what about unintended situations, how do we mitigate against lots of potential known and unknown situations that the plastics may end up in?

- Comment to above: Since biodegradable plastics are designed for ending up in the environment (which is not the case for traditional ones) it should made sure that they do not contain toxic chemicals since these will eventually end up in the environment.

**SURPASS** -detecting LCA/LCC, toxicological hotspot of raw material prior to experimental cycle (from production to reprocessing and end-of-life); -tracking additives (inventory) -release and exposure passement of IAS and NIAS of final products; -avoiding any potentially hazardous chemicals

**SEALIVE** -Mesocosm studies for environmental (aquatic environments) impact assessment of biobased polymer solutions.

**NENU2PHAR** -works on the definition and implementation of suitable Safe-by-Design strategies to guarantee a high level of protection of the human health and the environment in the product innovation process when dealing with the materials and process developed under NENU2PHAR (PHA based formulations).

- complete this safe by design approach by using a modelling tool developed as part of the French ANR project SFPD (Safe Food Pack Design). The substances used in NENU2PHAR will be subject to physico-chemical and thermodynamic specifications in order to complete the databases associated with FMECaengine. Validation of the migration will be done by the use of specific migration tests on the project's films and containers.

- is working with nanocrystals of cellulose and starch, assessment of risk when handling nanofillers will be done on different Partner site

**Redondo** -Hazard assessment with in vitro toxicological studies - Assessment of occupational exposure - Additive's inventory

**PRESERVE** -raw materials and feedstock selection done taking into account human and ecotoxicity.

### *Subtopic: "Recyclability of bio-based plastics (e.g., creation of value chain, market volumes)"*

**SEALIVE** -Improvement of current sorting technologies and procedures: - Embebed RFID labels into polymers for traceability of final product. - Fluorescent markers. - NIR technologies to sort biobased plastics with 99.9% accuracy



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**NOOSA** -produces biobased textile fibbers and yarns (for clothing), based on plant resources. We focus on the recyclability of the material, to achieve 100% material recovery. In fact, we have developed a recycling technology that allows full material recovery without deterioration. With this process we hope to eventually achieve a closed loop system where the introduction of virgin material is not necessary anymore. Pre-consumer and post-consumer waste will be recycled.

**Biotransform** -Assessment and impact tool to identify potential and underutilized infrastructure at the regional level. Enables the mapping of bioeconomic value chains for local stakeholders in a comprehensible way. Identifies bottlenecks related to sourcing, and recycling technologies and can guide investments in the appropriate direction.

**MIX-UP** -great options for purified plastic, however, missing possibilities for mixed plastic - polyester combine recyclability with (emergency) biodegradation (https://doi.org/10.1038/s41929-020-00521-w) Lars Blank

**NENU2PHAR** -goal of NENU2PHAR is to build up the most suitable scenarios for the EoL of the demonstration cases and to validate sustainable solutions for the end-of-life phase of the resultant new bio-based products. Different scenarios are envisaged to validate that the environmental footprint at the end of life will be better than the fossil based: Mechanical recycling, chemical recycling, Home and industrial composability. Mechanical recycling will be the preferred option. The circularity of the end-of-life of the NENU2PHAR products will be evaluated. Different scenarios based on business-driven models will be established in order to optimize the upcycling and circularity of the NENU2PHAR materials.

-is developing a protocol to sot PHA based formulations. Development on suitable library based on bioplastics and use of markers

**PRESERVE** -Bio-based plastics and fibre-based packaging materials to be recovered a reused in upcycled packaging.

**Herewear** partner Circular. -Fashion is working on design software tool which will also include guidelines/possibilities on the recycling of the biobased garments

**Redondo** -Recyclable-by-design crosslinked PE

**SURPASS** -general goal is to produce novel materials to be recyclable-by-design, with the possibility of recovering 100% of the material to be recycled for the same purpose by exploiting vitrimer chemistry and MNL technology (to reduce compatibilizers). -development of novel reprocessing and purification technology to achieve 100% recyclability

**REPurpose** -will study different EoL solutions not only recyclability but also considering e.g., also reuse

**CHAMPION** project (BBI-JU) -targets include bio-based coatings and adhesives, so product which are hard and durable, however the type of chemistry used allows to reverse the polymerization process, so they can be broken down at the end of life, which is perfect for glues etc.



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## 7.3. ANNEX 3: Results of the 3rd discussion topic: Raising awareness, stakeholder engagement, collaboration and coordination

***Subtopic: "Scientific knowledge transfer to relevant actors (policymakers, industry and society)"***

**SUSTRACK** -relevant stakeholders: policy makers, business leaders, authorities, action groups, civil society, NGOs -organizing conferences at the EU and national level -create tools and contents to support communication and dissemination activities, including a brand identity, website, promotional materials (e.g., flyers, presentations, posters, roll-ups, social media banners and videos), communication and dissemination materials (e.g., press releases, newsletters, training materials) and actionable knowledge stemming from all WPs (e.g., factsheets, infographics, etc.) to maximize project impact and community/public awareness -create publications and social media profiles and participate in events, fairs, conferences, workshops and informative webinars -organize a final event to present the SUSTRACK outcomes to the EC and other relevant stakeholders

**CHAMPION** project (BBI-JU) -is a technical project, and will produce a policy recommendation document

**Biotransform** -Assessment tools on a regional Level to ensure that local politician or stakeholders have the knowledge, what feedstock can be used and how the creation of the value chain should look like. The end result should be an easily and comprehensively understandable guideline for policymakers.

**GLAUKOS** -project Stakeholder Labs activities to involve industry + Partners to showcase products at industrial fair events

**BIO-PLASTICS EUROPE** -Case studies being used as means of communicating the benefits of sustainable business models

- Stakeholder workshops have engaged with actors across the value chain to co-create policy recommendations, protocols, and circular business models

**NENU2PHAR** -Diverse survey support tools are used, including semi-directed interviews, questionnaires, focus groups, mind mapping, workshops with consumer organizations representatives

**PRESERVE** -Will curate the provision of policy recommendations regarding resource efficiency improvement, waste management, recycling and EoL scenarios tuned for specific applications, that could be used by standardization bodies in the reflection about new/ improved standards. The outcome of the evaluation of the project results, especially in terms of recyclability, biodegradation tests and LCA, will also be used in position papers addressed to relevant actors.



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-Leading Working group on policy with CLUSTER of H2020 Projects, to tackle common challenges, topics and policy recommendations.

**SEALIVE** -Specific dissemination plan to transfer the scientific outputs of the project to the public and other key stakeholders, including policymakers. Meetings and training sessions with key stakeholders

**REPurpose** -knowledge exchange and collaboration and networking with other initiatives and projects targeting SSBD material → planned workshops with the involvement of policy makers

**SURPASS** -data sharing with interested third parties and stakeholders; -open science practices mandatory; -digital infrastructure for guidance to European SMES; Stakeholders' and citizens' engagement/awareness activities; -stakeholder workshop on SSbD hot topics

**Smartbox** -Workshop to show the developed technologies and products (as satellite event to Pitch Perfect 2023, end of September) + Partners to showcase products at industrial fair events

**Herewear** -organize local workshops with relevant actors over value chain - develop EU policy brief - building Herewear community of like-minded actors to help creating a network for sustainable clothing & textiles

**Food Packaging Forum** (FPF) Foundation (AURORA project partner) is a foundation for science communication and scientific research. - We share the latest science on chemicals in food packaging (conventional and "bio") and on the environmental and human health impacts of food packaging (see here) - We develop and provide independent, science-based, and balanced information and tools that are accessible and understandable for stakeholder outside research (e.g., factsheet on bioplastics to help consumers and retailers make evidence-based decisions on when bioplastics make sense for them; here) - We establish dialogue and cooperation between stakeholders and enable them to apply the latest science to their decision making. - We provide the scientific evidence needed for informed policymaking

**LABPLAS** -Project: MOOC (Massive Open Online Courses) on SMNPs

### *Subtopic: "Connect initiatives at local, national, and EU level"*

**SURPASS** -engaging with EU funded projects with a focus on SSbD and recyclability; -liase national and EU initiatives -Mapping Eu and nationals legislation frameworks on SSbD

**EuBioNet** -stimulates the debate through thematic working groups to discuss relevant challenges, aggregate results from different projects, and facilitate their exploitation in local and regional contexts, in order to support the bioeconomy ecosystem creation. - The EuBioNet methodology and experience could provide inspirational insights for future projects and initiatives connecting EU-funded research with the local, national, and EU beneficiaries.

**PRESERVE** -Collaboration with projects funded under the same topic as PRESERVE. Crowdhelix platform to engage with other initiatives in circular plastics.



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**Shaping Bio** -shaping the future of bioeconomy on EU, national, regional level for policy and governance, applied R&D+tech transfer, Collaboration and Financing, One aspect we considering to focus on plastics

**LABPLAS** -Project Interesting initiatives for a more transparent communication on composition of materials are currently ongoing within the context of the Sustainable Product Initiative and in the related Digital Product Passport development.

**Herewear** -community with quadruple helix model in mind - workshops with local actors, focusing e.g., on the local feedstocks available

### *Subtopic: "Mobilize citizens and society for the scale-up of solutions (from niche to norm)"*

**EuBioNet** -The project BIOVOICES organized more than 70 Mobilization and Mutual Learning Workshops involving quadruple helix stakeholders, stimulating the debate around a conceptual model developed by Wageningen University. The MMLs hosted case studies from research projects and industrial innovation in the bioeconomy and bio-based sectors in order to inspire and inform policies at European, national, regional, and local levels. - BIOVOICES contributed to stakeholder empowerment and facilitation of systemic thinking for the uptake of the bio-based economy.

- Transition2Bio contributed to the conceptualization of awareness, communication, and stakeholder engagement in the bioeconomy by creating the three-dimensional model "BIOWHAT, BIOHOW, and BIOACT", stemming from the extensive and impactful communication activities that have been implemented by several European-funded projects. - This model's objective is to provide a framework by which to map and organize bioeconomy communication activities, thereby targeting stakeholders with different levels of maturity with regard to awareness of and engagement with the bioeconomy.

**NENU2PHAR** -will organize a workshop in April 2023 to maximise civil society awareness and consumer acceptance of NENU2PHAR products. Location at IPC Alençon and organized by LOMARTOV

The **UPLIFT** project -will at a later stage involve the stakeholders in co-creation processes to create platforms for not only knowledge but certainly also seek to bring UPLIFT into the practices of the end-users - to create "sustainable citizens"

Report of the **BIOGEARS** workshop with stakeholders on the opportunities to shift towards biobased Aquaculture gears: https://biogears.eu/wp-content/uploads/2022/10/BIOGEARS-Workshop-report-Oct22_Public_FINAL.pdf,"https://biogears.eu/wp-content/uploads/2022/10/BIOGEARS-Workshop-report-Oct22_Public_FINAL.pdf"

**MIX-UP** -children universities (e.g., Dublin, Aachen) - Science night and other activities - weekly BLOG (www.mix-up.eu) - monthly seminar with many EU projects and other stakeholders invited - citizen science exhibition and engagement - World Expo 2022, Dubai featuring biotechnological "plastic waste to plastic value" - bridging between Eu and China (we.chat and more) Lars Blank



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### *Subtopic: "End-users' behaviour and impacts of bio-based and biodegradable plastics"*

**REPurpose** -considering Responsible Research and Innovation approach that will help the consortium ensure broader social support

**BIO-PLASTICS EUROPE** -Discussions at stakeholder workshops have reflected on current (low) levels of knowledge, awareness and (unrealistic) expectations of end users concerning BB/BP plastics (including correct use and end of life)

- Discussions at stakeholder workshops have reflected on the potential confusion consumers face wrt. BB/BD plastic products. - Does end user facing communication or marketing of BB/BD plastics create more issues than it solves. - Does a consumer actually need to know that a product is BB/BP? - Or is the important information actually what is the expected behaviour re: end of life...

**PRESERVE** -Consumer perception literature review and studies to assess the acceptance of developed products

**EuBioNet** -Building on the experiences of projects like BIOVOICES, BIOWAYS, Transition2Bio, BIObridges, AllThings.bioPro, LIFT and other CSAs or CSA-like projects, the awareness and education of consumers (but also the end users like fishermen) are key for the sustainable uptake of bio-based and biodegradable solutions. - Key elements like motivational drivers (economic, social, environmental) and barriers (misconceptions, resistances, behaviours) should be considered in the design of effective policies and actions supporting the transition.

## 7.4. ANNEX 4: Results of the 3rd discussion topic: Projects' contributions to EU policies

### *Subtopic: "Limit the use of biodegradable plastics in the open environment to specific applications for which reduction, reuse, and recycling are not feasible Projects' point of view."*

**BIO-PLASTICS EUROPE** -Relevant for the following sectors: agricultural mulch film, fishing lures, aquatic geomembranes

- We are doing this indirectly by developing and implementing a framework to assess the suitability of biodegradability for our applications of focus.

Useful links (from **EuBioNet**) BioSinn – Products for which biodegradation makes sense (PDF) https://renewable-carbon.eu/publications/product/biosinn-products-for-which-biodegradation-makes-sense-pdf/

**LABPLAS** Project -We agree. Biodegradable plastics shall be used mainly for those applications in which loss cannot be avoided.

**UNKNOWN** -consumers are asking about real sustainability. Are these products really sustainable, does it make sense?



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**SEALIVE** -To propose biodegradation as an additional EoL in those cases in which the final product could finish as litter in land or sea.

**BIOGEARS-** To increase the substitution potential of conventional plastics by biobased plastics in aquaculture gears (which can also apply to fisheries), a suitability study is needed for applications or gears that can be more easily substituted regarding their technical and mechanical characteristics, durability, replacement frequency, and potential to be lost. Besides, durability/degradation models can exist for conventional materials but are inexistent or difficult to assess for biobased materials (and gears), which need to be studied as real time degradation studies are not possible for gears intended to be used for more than 10 years, as is the case for mussel aquaculture ropes.

### *Subtopic: "What role for biobased and biodegradable plastics in reaching the 2030 targets of the EU Zero Pollution Action Plan"*

**MIX-UP** -very important, as the sentence will stand - "if we use plastic, we will lose plastic". Hence, we need (emergency) biodegradation. We have to get the promising polymers a niche to develop. Hence, PHA should be considered a natural plastic, as done in about half of all EU member countries. Where do we see however the development, although European researchers were for decades very strong: in Asia and the US. Lars Blank

**PRESERVE** -2030 roadmap to be prepared at the end of the project (2024) to outline the pathways to significantly influence the emergence of bio-based packaging and create jobs and growth in the sector.

**BIO-PLASTICS EUROPE** -Broader question: In society, what is the role of any plastic? and which are most appropriate to be substituted by biobased or biodegradable materials.

**LABPLAS** Project -Biodegradable plastics are not the overall solution to plastic littering. This must also be fought at the source by changing consumer behaviour among others.

**BIOGEARS-** To reach net zero pollution a real circular economy of biobased plastics should be addressed, increasing the use of second and especially third generation materials as biowaste to generate bioplastics. Consumers' awareness on the circular use of biowaste to create added value products as bioplastics that can substitute conventional plastics generating social benefits (reduce environment impact, use of biowaste, circular economy, employment, etc.) could also boost sustainable consumption.

**NOOSA**- Biobased and biodegradable plastics such as PLA could be included in the EU ECOLABEL criteria especially for the textile category. This would allow the democratisation of biobased and biodegradable plastic.

### *Subtopic: "Recommendations and research data from projects to support EU policies"*

**PRESERVE** -Policy recommendations regarding resource efficiency improvement, waste management, recycling and EoL scenarios tuned for specific applications, that could be used by standardization bodies in the reflection about new/ improved standards.

**EU cluster CUSP** AURORA, IMPTOX, PLASTICHEAL, POLYRISK & PLASTICSFATE -Early in 2021, the EC funded five large-scale research projects under the European Union's Horizon 2020 research



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and innovation programme. These five projects have formed the European Research Cluster to Understand the Health Impacts of Micro- and Nanoplastics (CUSP). In close collaboration with the European Commission's Joint Research Centre (JRC) and a constant dialogue between scientists, stakeholders and policy makers, CUSP is enhancing the policy relevance and impact of the research, as described in our first policy brief: Foss Hansen, Steffen. (2022). Regulatory Relevance of the European Research Cluster to Understand the Health Impacts of Micro- and Nanoplastics (CUSP). Zenodo. https://doi.org/10.5281/zenodo.7101443

**SUSTRACK** -Development of policy recommendations and guidelines for the sustainable transition considering: -(a) the strategic goals of the circular, bio-based economy (as defined in, e.g., the EU Bioeconomy Strategy, the Farm to Fork Strategy and the EU Circular Economy Action Plan); - (b) state-of-the-art knowledge on the design of policy instruments in a multi-level, multi-sectoral policy field; and - (c) compatibility with the EU Green Deal and legal requirements.

**BIO-PLASTICS EUROPE** -We will develop policy briefs focusing on the role of biodegradable and compostable plastics in a circular economy, and policy recommendations to support this shift - This is also supported by the materials development and field tests, and engagement with private sector and industry - which all feed into policy recommendation development

**SURPASS** -starting point is the existing Eu legislation framework and following updates (to be kept on track); -discussion with stakeholders, policy makers, and industrials to identify trade-offs -unambiguous (as much as possible) guidelines for SSbD manufacturing.

**SEALIVE** -Participating in expert roundtable in Brussels or other appropriate locations from the European policy making environment to give recommendations based on the developed biobased solutions. One Policy toolbox with recommendations to support the new biobased developments.

**LIFT** -was aggregating results from EU funded projects clustered thematically. 1) the problem 2) how the projects addressed 3) the gaps still to be addressed 4) recommendations

**Herewear** -one of the deliverables is a policy brief with recommendations based on the project results

**MIX-UP** -it is „nice“if the EU discusses the pro- and cons of biodegradable plastics. However, we will get them anyway, as China announced 15+ million tons of production capacities in 2021 alone, motivated by policy changes. Chinese companies produce about twice as much plastics (all polymers, materials) as the sum of all EU companies, tendency strongly in favour of China. We have to consider this aspect, as we have to take care of the end-of-life of these materials here in Europe.

**STAR4BBS** -A preliminary task of STAR4BBS is to identify sustainability targets (included in policies) and related challenges, whose achievements should be drive and monitored by the adoption of certification schemes and labels.



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### *Subtopic: "How to shorten the gap between projects' outcomes and policies"*

**Biotransform** -a practical guideline targeting regional authorities and listing key principles and recommendation for a regional governance toward a circular bio-based economy, as well as how to fund and finance this transition. It will include general recommendations and short presentations of actual practices identified

**PRESERVE** -Strategy outlining the steps to move the PRESERVE solutions from TRL6+ to TRL 9 will be prepared capturing the key findings and remaining knowledge gaps arising from the project as well as the interdependences across the supply and value chain.

**SEALIVE** -Closely collaboration with other identified project in order to combine their new developments and gaps in policies for sustainable solutions for bio-based plastics on land and sea.

**SUSTRACK** -The path towards exploitation will be by way of the EU level conference co-creation workshop and presented to selected regional, national and EU policy makers in six policy roundtable discussions in the partners' respective countries, in the context of the national conferences.

**STAR4BBS** -involving stakeholders in the implementation of the project, via co-creation workshops

An example from Usable Packaging project - open letter to European Institutions with 7-point strategy to integrate biobased and compostable plastics into the EU's bioeconomy. - https://www.linkedin.com/posts/usablepackaging_biobased-compostable-plastics-activity-6983336983922102272-eDB7?utm_source=share&utm_medium=member_desktop,"https://www.linkedin.com/posts/usablepackaging_biobased-compostable-plastics-activity-6983336983922102272-eDB7?utm_source=share&utm_medium=member_desktop"

**BIO-PLASTICS EUROPE** -organizing live event with EU policy officers on 23rd November push forward to requirements/ instructions provided from the EU to the projects in advance



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