European Innovation Council

CHALLENGE GUIDE

PATHFINDER CHALLENGE Nature inspired alternatives for food packaging and films for agriculture

EIC Work Programme reference: HORIZON-EIC-2024-PATHFINDERCHALLENGES-03
Call deadline date: 16 October 2024
EIC Programme Manager: Ivan Stefanic

The EIC will hold an Info Session on this Pathfinder Challenge call on March 20, 2024, between 09:00 and 13:00 CET. Participants can access the meeting as guests at https://webcast.ec.europa.eu/information-day-eic-work-programme-2024-pathfinder-challenges-2024-03-20.
Participation in the meeting, although encouraged, is optional and is not required for the submission of an application. A recording of this Info Session will be made available on the same URL. Notifications of additional dissemination events can be found at https://eic.ec.europa.eu/events/save-date-european-innovation-council-pathfinder-challenges-work-programme-2024-info-day-2024-03-20_en.

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1. About this document

The Challenge Guide serves as guidance and background for the common understanding, participation rules and obligations for the EIC beneficiaries that are involved in the Challenge Portfolio. Contractual Obligations are further detailed in the EIC Work Programme 2024 https://eic.ec.europa.eu/system/files/2023-12/EIC-workprogramme-2024.pdf

The Challenge Guide is a guidance document accompanying a Pathfinder Challenge call for proposals to provide further information about how "Portfolio Considerations" will be taken into account in the evaluation of proposals.

The Challenge Guide is prepared by and under the responsibility of the relevant EIC Programme Manager (information about the EIC Programme Managers is available on the EIC Website https://eic.ec.europa.eu/eic-communities/eic-programme-managers_en). It complements the Scope, Specific Objectives and/or Specific Conditions set out in the EIC Work Programme by a description of the portfolio considerations and how a portfolio will be built. The presentation provided by the Programme Manager during the Info Day will give applicants a further opportunity to understand the background of the call, and to ask questions to the Programme Manager. In no case does the Challenge Guide contradict or supplant the Work Programme text.

Following the selection of a proposal to be funded under the Challenge, the Programme Manager will work together with the consortia of the selected projects to develop a common roadmap with a strategic plan for the Challenge. This roadmap/ strategy plan will integrate the activities and milestones of the individual projects into a shared set of objectives and activities across and beyond the projects. The roadmap serves as a common basis for the project portfolio and may affect the project implementation - including possible adjustments, reorientations, or additional support to projects. The roadmap will be updated in light of emerging results or issues during the implementation.

2. The scope and objectives of the Challenge as defined in the Work programme

This section is a copy of the Challenge call in the EIC work programme text. Proposals to this Challenge are expected to explain how they relate to and intend to go beyond the state of the art, and how they interpret and contribute to the objectives of the Challenge.

2.1 Background and scope

The food production system is heavily reliant on fossil fuel derived plastics. This reliance spans both the early stages of the production process, for example in mulch foils and mineral fertilizers coating through to the latter stages in which food and beverages are packaged to

enable food transportation, preservation, hygiene and safety, increasing the lifespan of foods and contributing to safety of foods and the retention of their nutritional content.

Plastic's low cost, durability, and linear use with low levels of recycling is the source of numerous environmental challenges that impact whole ecosystems particularly at the end of life. These environmental impacts are further accentuated by coating agents and formulation additives that deliver a range of functional properties. These additives can in turn leach out into the surrounding environment including air, water, food or animal and human body tissues, in particular during biodegradation.

This Pathfinder Challenge aims to support ambitious interdisciplinary research that will lead to the development and production of sustainable nature inspired alternatives for food packaging and agricultural production such as, but not limited to, greenhouse and mulch films. These materials must have a reduced environmental impact, through design and production, while delivering the functional characteristics of plastics.

Proposals should look to bring forward ideas that span the product lifecycle from the development of novel sustainable materials, their design and production through to end of life, while maximising the time and extent of use. Abundant, naturally occurring materials that display properties to be optimized for food related applications with a reduced environmental footprint in production and enhanced scope for re-use recycling and biodegradability, including in extreme environments, will be encouraged.

Applicants are encouraged to develop synergies with relevant activities under Horizon Europe Cluster 6 Work Programme 2021 – 2022 and Work Programme 2023 – 2024, and its partnerships, in particular Circular Bio-based Europe Joint Undertaking (CBE JU).

2.2 Specific objectives:

The Challenge seeks groundbreaking proposals with the capacity to replace the use of fossil-carbon-based plastics from farm to fork and thereby support EU policy ambitions to move towards a more circular, resource efficient and climate neutral economy.
Proposals must seek to deliver nature-inspired sustainable alternatives to fossil carbon derived plastics and associated production processes. These alternatives shall be circular, safe and sustainable by design and allow for reusability, recyclability and full biodegradability. They must look to address one or more of the current uses of plastics in the food system (e.g., agricultural mulch, food packaging), and utilise bio-based sources and raw materials such as:

- polymers extracted from nature (e.g., cellulose, chitin, lignin, keratin)
- natural polymers (e.g., microbial, fungal and plant materials), or
- synthetic polymers from biobased materials.

Attention should also be paid to consider regulatory aspects in the development and incorporation of chemical additives that can deliver high sanitary standards for contact with food. The additives must be formulated in a way to meet set of biodegradability criteria and the assessment of the ability of the products to fully biodegrade in natural soil and aquatic environments across the EU.

All projects must demonstrate at least preliminary evidence of an improved cradle-to-gate and cradle-to-grave lifecycle assessment, when compared to fossil carbon derived plastics and current additives. This lifecycle assessment must take account of environmental, social and economic considerations. The resulting materials and associated processes must over their lifecycle:

- Reduce energy consumption and the carbon footprint
- Reduce water consumption and associated environmental footprint
- Enhance biodegradability, compostability or reusability

They must also include one or more enhanced functional characteristics for use in the food value chain while minimising or potentially eliminating the harmful effects with a view to:

- increasing shelf life and retaining the nutritional properties of packaged food, and
- enhancing the productivity and functionality of agricultural films

This could include the use of smart functionalities in responding to environmental conditions and the use of biodegradable electronic features.

Projects with strong capacity for use beyond food and agriculture (e.g. packaging for pharmaceuticals) will also be encouraged and prioritised.
Irrespective of starting point, the resulting outputs of the projects must be shown to be effective for their intended application with, at the very least, a lab-based demonstrator i.e., reach TRL 4 or above.

2.3 Expected outcomes and impacts

The projects selected under this Challenge are expected to collectively provide a portfolio of environmentally friendly materials and use cases informed by availability, efficiency and end functionality. Further, funded projects will be expected to work together to develop a robust approach to measure the lifecycle impacts i.e., the environmental, social and economic consideration of the funded projects.

The successful implementation of these Challenge projects will lead to a paradigm shift in the food and agriculture sector. It will in the medium-term lead to the development of a new group of nature-inspired materials that are commercially viable, environmentally sound and support moves towards a more circular, resource efficient and environmentally sustainable economy. These will help the sector reduce pollution in soils, sediment, inland water and

oceans, and decrease contamination of food, animal and human tissues with micro and nano plastic particles and leeched additives.

3. Portfolio considerations for the evaluation of applications to the Challenge

This section describes how portfolio considerations will be taken into account in the second stage of the evaluation. For more details of the full evaluation process please refer to the EIC Work Programme..

3.1 Categories/ Building blocks

The portfolio-building process will be based on the preliminary allocation of the proposals, addressing one or more of the current bio-based sources and raw materials (1) and uses of plastics in the food production system (2), such as but not limited to either: food packaging materials or films for agriculture or both.

Correspondingly, there are three major categories, summarised in the table below with a non-exhaustive list of possible values/components for each category.

CATEGORY	VALUES/COMPONENTS
1. Bio-based sources and raw materials	i. Polymers extracted from nature (e.g., cellulose, chitin, lignin, keratin). ii. Nature-inspired polymers (e.g., through synthetic biology, microbial, fungal and plant materials). iii. Synthetic polymers from biobased monomers and raw materials.
2a. Types of food packaging materials regarding their properties	a) Different mechanical properties (rigid, semi-rigid, flexible). b) Different thermal properties (e.g., exposure to heating or cooling during transport/storage). c) Different wetting properties (wettability toward water, from hydrophilic to highly hydrophobic). d) Different barrier properties toward different gases (porosity and free volume control for gas diffusion minimization/maximization). e) Different properties regarding visible

	light transmission (transparent, non-transparent). f) Different structural function (e.g., standalone, inner/outer coating layer).
2b. Types of films for agriculture	a) Films for polytunnels. b) Films for mulch.

3.2 Portfolio considerations

The evaluation committee will aim to compose a portfolio covering a wide range of possible uses in the food system. While building the portfolio, an emphasis will be given on proposals covering the application in food packaging.

Within and among these areas, the evaluation committee will look at shared components or potential complementarities among the projects, in areas where this can be a clear added value for the development of synergies and collaborations among the projects in the portfolio.

Starting from the highest ranked proposal, a portfolio of proposals will be selected based on shared components/complementarities, while ensuring broad coverage of uses in the food system. The consideration of shared components and complementarities will enable the evaluation committee to group proposals and to identify a recognisable transversal pattern constituting the portfolio. For instance, if a shared component is lacking in a proposal originally ranked among the top ones, and which is found in the further proposals down the list, this will result in its displacement by another one clearly aligning with the already identified desired pattern, found within the top ranked proposals, that will eventually define the actual portfolio.

Consequently, this means that the projects selected for funding after the second step (portfolio considerations) may differ from the ranking list established from the first step (based on score).

4. Implementation of the Challenge portfolio

Once selected, projects will be expected and obliged to work collectively during the implementation of their projects under the guidance of an EIC Programme Manager. This section summarises some of the key aspects of this pro-active management which applicants should take into account in preparing their proposals.

4.1 Proposal preparation and grant negotiations

Applicants may be requested to make amendments to their proposed project to take into enhance the portfolio. Such changes may for instance include additional tasks to undertake common/ joint activities (workshops, data exchanges, joint research, etc) with other projects in the portfolio.

Based on first experience, it is advised to foresee in your proposal a dedicated work package for portfolio activities and to allocate at least 10 person-months (see below for the purpose and examples of such activities). You may propose concrete activities or remain generic in your description.

If you fail to do this during proposal time, your proposal will not be scored lower during the evaluation, but in case your proposal is selected for grant agreement preparation, you will be requested to add the portfolio work package to your grant agreement. Please be aware that in that case the maximum grant you receive will not change, and you will need to find the resources for portfolio activities within the foreseen project budget.

4.2 Challenge portfolio roadmap/ strategy plan

This Portfolio aims at:

- Ground-breaking proposals with the capacity to replace the use of fossil-carbon-based plastics from farm to fork. Projects must look to address one or more of the current uses of plastics in the food system and utilise variety of bio-based sources and raw materials with special attention paid to the added chemical additives.
- All proposals must demonstrate at least preliminary evidence of an improved cradle-to-gate and cradle-to-grave lifecycle assessment, when compared to fossil carbon derived plastics and current additives. One or more enhanced functional characteristics and features for use in the food value chain must also be addressed while minimising or potentially eliminating the harmful effects.
- The projects selected under this Challenge are expected to collectively provide a portfolio of materials and use cases informed by availability and end functionality., even going beyond food and agriculture applications. Ensuring that portfolio members, can access a much higher number of relevant applications to explore key partnerships.

Following the selection of a proposals to be funded under the Challenge, the Programme Manager will work together with the selected projects to develop a common strategy plan/roadmap for the Challenge. This plan will integrate the activities and milestones of the individual projects into a shared set of specific objectives and cross-project activities. The roadmap serves as a common basis for implementing the projects - including possible adjustments, reorientations, or additional support to projects - and can be updated in light of emerging results of difficulties during the implementation. The objectives can be revised, for

instance based on projects' unexpected achievements, new technology trends, external inputs (other projects, new calls…).

In particular, the Challenge roadmap/ strategy plan will include activities on the transition to innovation and commercialisation, and to stimulate business opportunities. These activities may be reinforced during the implementation with additional funding and expertise through pro-active management.

Non-exhaustive examples of activities towards the above-mentioned aims are:

Technology:

- Comparing performance of technologies, developing common benchmarks and standards.
- One project may use the results of another project, building future value chains.

Regulatory:

- Analysis of the barriers in the supply chain: Main barriers (legislation especially related to regulatory framework, standards, IP, etc…) will be identified and actions to be taken to overcome them will be proposed and as far as possible implemented. Access to Open Innovation, Test Beds and other research infrastructure, access to new markets through multipliers like Enterprise Europe Network, and business models can be also a topic of joint interest.

Transition of technology to innovation

- Market and demand analysis: Analysis of the market demand and maps of targeted sectors (e.g., industrial, mobility, communications...) and their specificities will be performed. Market research analysis results can be exchanged with other portfolio projects to identify specific stakeholders of common interest with which the entire portfolio can establish partnership(s) of much higher impact as opposed to that of the individual project.
- Investors or other stakeholders: Effectively communicate of any key outcome of the research work of the portfolio members collectively and/or an individual project, to early-stage private investors or relevant players focused on the same field.

Communication and dissemination:

- Effectively communication of any key outcome of the research work of the portfolio members collectively and/or an individual project, to early stage private and corporate

investors focused on the same field. Such communication might also be addressed to the general public to increase social acceptance for proposed solutions, or to other researchers and stakeholders through common dissemination activities at scientific conferences or trade fairs.

- Organising joint conferences, workshops, summers schools, etc.

These tasks require the active participation of portfolio members to a series of meetings called for and steered by the Programme Manager.