

***EIC Pathfinder Challenges:
Evaluator's perspective***

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II.	EIC PATHFINDER.....	22
II.1	EIC PATHFINDER OPEN	22
II.2	EIC PATHFINDER CHALLENGES	27
	<i>II.2.1 Biotech for Climate Resilient Crops and Plant-Based Biomanufacturing</i>	<i>34</i>
	<i>II.2.2 Generative-AI based Agents to Revolutionize Medical Diagnosis and Treatment of Cancer</i>	<i>37</i>
	<i>II.2.3 Towards autonomous robot collectives delivering collaborative tasks in dynamic unstructured construction environments</i>	<i>41</i>
	<i>II.2.4 Waste-to-value devices: Circular production of renewable fuels, chemicals and materials</i>	<i>46</i>

- ‘EIC Pathfinder Challenges’ to support coherent portfolios of projects within predefined thematic areas
- with the aim to achieve specific objectives for each Challenge.

Challenge II.2.1

Biotech for Climate Resilient Crops and Plant-Based Biomanufacturing

The proposals should work on both the following objectives:

- **Increasing plant growth, yields and resistance to stress** through:
 - o Enhancing tolerance to stress combinations occurring due to different climate scenarios that include the simultaneous exposure of crops to different stresses e.g. heat combined with drought, salinity, flooding, high CO2 levels, as well as indirect effect of climate change via altered composition and behaviour of weeds, insects, pathogens and soil microbiome and possible impact of human-generated pollutants.
 - o Increasing water use efficiency and nutrient use efficiency compared to current crops in commercial use.
 - o Improving plant reproduction and seed filling processes under unfavourable conditions caused by combination of at least two stress factors.
 - o Investigating and enhancing plant and soil microbiome interactions.
- **Substantially increasing the nutritional value (e.g. proteins, vitamins) in crops through plant native and non-native ingredients in crops.**

Challenge II.2.2
Generative-AI based Agents
to Revolutionize Medical Diagnosis and Treatment of Cancer

- Specific Objectives:
 - Project proposals under this Challenge should **focus on one (and only one)** of the following diseases:
 - breast cancer, cervical cancer, ovarian cancer, prostate cancer, lung cancer, brain cancer, stomach cancer or colorectal cancer.

Each proposal should address both the following areas (at least one sub-objective from each of the areas):

- **Area 1: Technological area**
- i. GenAI-based tools for Integrating Multidimensional Multimodal health Data
- ii. Medical Data Augmentation
- iii. Medical Knowledge Representation and Integration

- **Area 2: Clinical Area**
- i. Predictive Diagnosis
- ii. Enhance Personalized Treatment Selection

Area 1: Technological area (1)

i. GenAI-based tools for Integrating Multidimensional Multimodal health Data

- Investigate groundbreaking techniques and methodologies for developing GenAI algorithms that combine multidimensional (e.g. time dimension, space dimension) and multimodal data from various sources. These include multiple imaging modalities (e.g., MRI, CT, PET, X-ray), clinical data (e.g., electronic health records, lab results, structured and unstructured clinical data, pathology results, genetics and –omics data, videos, knowledge databases, and other resources).
- The goal is to provide a **comprehensive view of the patient's condition**.
- The developed algorithms should be capable of producing unified and actionable datasets that can be exploited for the development of the AI tools described in Area 2 (clinical).

Area 1: Technological area (2)

- **ii. Medical Data Augmentation**
- Develop GenAI models based on groundbreaking techniques that are in the conceptual or initial experimental phase for medical data augmentation.
- These models should be capable of creating highly realistic synthetic medical data (images, genomics data, etc.) and generating complementary data from existing sources (for example producing synthetic CT images from MRI images), to support iterative cycles of model training.

Area 1: Technological area (3)

- **iii. Medical Knowledge Representation and Integration**
- Create an initial prototype GenAI model for medical knowledge representation and integration.
- This model should aim to develop a comprehensive and dynamic medical knowledge base,
to identify discrete medical imaging features associated with demographic information and systemic conditions,
to improve the interpretability of AI-based models
and extract new knowledge not previously identifiable by experts without assistance.

Area 2: Clinical Area

- i. Predictive Diagnosis
- ii. Enhance Personalized Treatment Selection

Area 2: Clinical Area (1)

- **i. Predictive Diagnosis**
- Develop an interactive autonomous agent
- capable of assessing the likelihood of a patient developing cancer
- by analysing their medical history, imaging data, and genetic information.
- The agent should provide personalised health risk predictions, enabling early detection and preventive measures.

Area 2: Clinical Area (2)

- **ii. Enhance Personalized Treatment Selection**
- Develop novel AI algorithms and architectures that leverages multidimensional and multimodal data integration, along with synthetic data generation, to predict the optimal treatment pathway for specific patient conditions,
- as well as to forecast disease progression and treatment efficacy providing a comprehensive view of patient care.

Challenge II.2.3

Towards autonomous robot collectives delivering collaborative tasks in dynamic unstructured construction environments

- The **overall objective** of this Challenge is the development of breakthrough technologies in the domain of autonomous collaborative on-site construction robots
- for an integrated, designed-for-robotics, digital production and assembly chain.
- The Challenge is open to the 3 main construction tasks applied to the 2 main construction segments of buildings and infrastructure.
- Innovative application in adjacent construction segments (for example coastal protection foundations for energy infrastructure) also fall within scope.
- Each funded project shall deliver the following 3 specific objectives:

Objective 1:

- Development of a simplified structural, load-bearing, material-robot building system to assemble a representative and future-relevant structure (pavilion) using a multitude of discrete modules (elements, segments, blocks, voussoirs).
- This system must demonstrate TRL4 (validation in laboratory environment) of the autonomous collaborative multirobotic assembly.
- The structure can represent an infrastructure (for example a bridge, tunnel, culvert, conduit), a building (for example a tower, vault, dome, arch, multi-story skeleton, wall) or other construction elements (for example a foundation, secant wall, barrier, sea wall).

Objective 2:

- Development of an autonomous mobile multi-robotic collaborative platform using at least two, preferably more, mutually aware collaborative robotic systems specifically designed for the assembly tasks outlined in Objective 1.
- This objective requires a structured systems engineering approach to conduct a thorough functional system analysis and to allocate system-level functions between humans and machines within the target autonomous mobile multi-robotic collaborative platform.
- The design should include the definition of system states and modes, along with the transitions between them, to ensure safe autonomous operations and effective demonstration of robot-robot and human-robot collaborations and interactions (passive, active, adaptive) at TRL4.
- The project should also describe how the proposed technology can be scaled to meet the full dimensions of the intended commercial application in future.

Objective 3:

- Achieve a **TRL4 demonstration** of an autonomous assembly sequence using the demonstration building system developed in Objective 1, executed by the autonomous mobile multi-robotic collaborative platform developed in Objective 2.
- The demonstration of a subsequent disassembly sequence is optional but encouraged if the building system is designed for disassembly.
- The demonstration will take place in a laboratory environment, including tests that explore the system's resilience and limits under controlled unstructured real-world conditions (for example fault tolerance, granular uneven surfaces, environmental obstacles).
- These tests aim to identify key weaknesses and recommend future technology developments.

Challenge II.2.4

Waste-to-value devices:

Circular production of renewable fuels, chemicals and materials

- The Challenge seeks ambitious proposals that address one (and **only one**) of the following focus areas:
- **Area 1: Fully integrated waste-to-value devices**
- **Area 2: Understanding underlying mechanisms by means of computational material science and AI**
- **Area 3: Cells from scratch by means of bottom-up synthetic biology**

Area 1: Fully integrated waste-to-value devices

This includes :

- 1) devices for converting waste streams into (feedstock for) fuels, chemicals and materials and
- 2) devices for remediation; where processes are solely driven by renewable energy sources (preferably directly by sunlight) and focus on the selective production of added value products, beyond hydrogen as the sole end product:
 - (i) Fully integrated solar reforming or synthetic biology devices, enabling the treatment of synthetic polymer materials, while delivering fast and efficient decomposition under sustainable reaction conditions (including the use of process chemicals).
 - (ii) Integrated capture and conversion technologies, capturing and converting feedstock from flue gases, or wastewater in a single step/ single device into fuels, chemicals and materials, providing increased energy- and materials efficiency as compared to not fully integrated process chains.
 - (iii) Membrane-based and electrochemical brine mining technologies recovering raw materials, CO₂ and water from seawater desalination brines.
 - (iv) Ex-situ remediation devices based on microbial/enzymatic and/or photocatalytic degradation, both purifying wastewater and seawater of noxious substances, metals, or nano-/microplastics, and producing added value remediation products. This should take place in a reactor, not in the open field.

Area 2:
Understanding underlying mechanisms
by means of computational material science and AI

- Projects in this focus area must deliver advances and scientific breakthroughs in the fundamental understanding of the underlying physical, chemical, and biological processes that will enable **fully sustainable and scalable waste-to-value devices**.
- Projects should address all the following specific objectives:
 - - Explore fundamental phenomena crucial to multiple waste-to-value device types, such as the development of efficient, stable and inexpensive catalysts, interface engineering and the effect of the surrounding medium.
 - - Develop more accurate and less resource-intensive quantum mechanical and AI methods to guide, predict and interpret reliably experimental works.
 - - Bridge the scales from describing properties at the atomic, mesoscopic level up to the macroscopic device level within a multiscale approach and describe phenomena over different timescales.
 - - Adopt a holistic approach to exploring phenomena applicable to multiple waste-to-value device types (aligned with Area 1).
- Devices stemming from Area 1 should serve to validate the developed theoretical models.

Area 3:

Cells from scratch by means of bottom-up synthetic biology

- Projects in this area must look to deliver scientific breakthroughs in bottom-up synthetic biology to enable the use of tailored microbial cell factories for the degradation and valorisation of waste and the production of fossil-free fuels, chemicals, and materials.
- Projects should address **all the following specific objectives:**
 - - Develop synthetic, fully artificial cells for future large-scale biotechnology applications, tailored to deliver desired functionalities such as carbon fixation or synthetic polymer decomposition.
 - - Engineer cell-like systems to produce compounds from abundantly available building blocks, such as water and carbon oxides.
 - - Engineer cell-like systems to decompose diverse types of waste, in particular synthetic plastic waste, into compounds that are valorisable as feedstock for a downstream production of fuels, chemicals and materials. At this stage, systems will not have to be completely autonomous and self-replicating, but the integration of different modules should be implemented.

Table 3. Award criteria for EIC Pathfinder Challenges

- 1. Excellence**
(Threshold: 4/5; weight 60%)
- 2. Impact**
(Threshold: 3.5/5; weight 20%)
- 3. Quality and efficiency of the implementation**
(Threshold 3/5; weight 20%)

Criterion 1: Excellence (Threshold: 4/5; weight 60%)

- **Objectives and relevance to the Challenge:**
How clear are the project's objectives? How relevant are they in contributing to the overall goal and the specific objectives of the Challenge?
- **Novelty:** To what extent is the proposed work ambitious and goes beyond the state-of-the-art?
- **Plausibility of the methodology:**
How sound is the proposed methodology, including the underlying concepts, models, assumptions, appropriate consideration of the gender dimension in research content, and the quality of open science practices?

Criterion 2: Impact (Threshold: 3.5/5; weight 20%)

- **Potential Impact**: How credible are the pathways to achieve the expected outcomes and impacts of the Challenge? To what extent would the successful completion of the project contribute to this?
- **Innovation potential**: How realistic is the proof of principle for demonstrating the potential impact of the technology for the challenge? How adequate are the proposed measures for protection of results and any other exploitation measures to facilitate future translation of research results into innovations with positive societal, economic or environmental impact? How suitable are the proposed measures for involving and empowering key actors that have the potential to take the lead in translating research into innovations in the future?
- **Communication and Dissemination**: How suitable are the proposed measures, including communication activities, to maximise expected outcomes and impacts for raising awareness about the project results' potential to establish new markets and/or address global challenges?

Criterion 3: Quality and efficiency of the implementation (Threshold 3/5; weight 20%)

- **Work plan**: How coherent and effective are the work plan (work packages, tasks, deliverables, milestones, timeline, etc.) and risk mitigation measures in order to achieve the project objectives?
- **Allocation of resources**: How appropriate and effective is the allocation of resources (comprising person-months and other cost items) to work packages and consortium members?
- **Quality of the applicant/consortium** (*depends if mono or multi-beneficiaries*): To what extent does the applicant / do all consortium members have the necessary capacity and high quality expertise for performing the project tasks?