HORIZON-CL4-2026-02-DIGITAL-EMERGING-53: Innovative AI methods and AI technologies for the process industries

1. General context of the topic

This topic focuses on the development and demonstration of **innovative AI-driven solutions** to enhance competitiveness and sustainability within **process industries**. It aims to accelerate materials and process development, improve plant operation and value networks, and foster safer, more efficient, and sustainable production environments. The call promotes the use of advanced AI paradigms — such as **multimodal generative AI, foundation models, and agentic AI** — moving beyond traditional predictive maintenance and quality control toward **adaptive, autonomous, and trustworthy AI systems** that can operate across the entire process lifecycle.

Projects are expected to leverage **AI methods and technologies** to optimize design, operation, and maintenance of industrial processes, while addressing data reliability, eXplainability, and integration within industrial OT/IT ecosystems.

2. Potential contributions from CARTIF

CARTIF can contribute substantial expertise in the following areas:

a) AI-based process modelling, control, and optimization

- Application of **AI-based algorithms for optimal automated process control** (e.g., drying operations) with multiple minimization constraints such as energy, temperature, and resource efficiency.
- Development of **physics-infused AI models** that optimize physical parameters in materials and processes, enhancing both **trustworthiness** and **explainability**.
- Integration of **AI for process planning, operation, and maintenance**, building on prior experience in project proposals.

b) Adaptive and autonomous AI systems

- Implementation of **AI solutions capable of adapting to context changes**, continuously learning from data streams to maintain accuracy and reliability.
- Deployment of **collaborative and autonomous robotics** for process operation, including **natural human-robot interaction** and **robot autonomy** for repetitive or hazardous tasks.

c) Data visualization, exploration, and decision support

- Development of **XR interfaces** and **immersive environments** for intuitive visualization of process data and AI-based insights, improving operator interaction and situational awareness.

- Integration of these systems with **FIWARE-based architectures** for interoperability and real-time data fusion.

d) Human and environmental safety

- Design of **AI solutions focused on health and safety**, including detection of poor postures, near-miss incidents and compliance with PPE (Personal Protective Equipment) policies.
- **Monitoring of worker health conditions** in hazardous environments (e.g., dust, high temperature, radiation) using sensor fusion and AI-based risk assessment.

e) Human-centred design and co-creation

- Application of **Design Thinking methodologies** from the proposal stage to identify key personas, user needs and pain points in process design, operation, and efficiency.
- Active user engagement and training to ensure effective integration of AI tools into the workforce and acceptance across different process sectors.

3. Target industrial sectors

CARTIF's experience is relevant to a variety of **process industries with adequate digital maturity**, including:

- **Minerals and construction materials** (e.g., asphalt, cement, ceramics).
- **Metallurgical industries** (steel, aluminium, lead recycling).
- **Chemical and bio-based industries** (fertilizers, bio-materials).

These sectors can benefit from CARTIF's expertise in process optimization, AI-based quality control and safety monitoring.

4. Potential CARTIF roles

- **Coordinator** of the proposal
- **Technical leader** for AI-based process modelling and optimization, leveraging hybrid and physics-informed approaches.
- **Work package leader** for adaptive AI systems and explainable, trustworthy AI.
- **Task leader** for XR-based visualization and decision support environments.
- **Contributor** to the co-design of use cases in collaboration with industrial partners and technology providers, ensuring end-user validation at TRL 4–6.