

## HORIZON-CL4-2026-05-DIGITAL-EMERGING-02: Next-Generation AI Agents for Real-World Applications in the ApplyAI sectors

### 1. General context of the topic

This topic focuses on the development of **next-generation AI agents** that can plan, reason, learn, and act autonomously to accomplish complex, multi-step tasks in real-world environments. These agents, powered by **Large Language Models (LLMs)** and **multimodal foundation models**, will advance towards more autonomous, adaptive, and reliable decision-making. The objective is to improve **autonomy, robustness, and collaboration** among multiple agents through decentralized frameworks, enhanced reasoning, and lifelong learning capabilities.

Projects under this topic are expected to create **multi-agent frameworks** capable of cooperative behavior, dynamic task allocation, and efficient resource usage, validated across the **ApplyAI sectors**. The resulting systems will represent a leap toward trustworthy, self-improving AI ecosystems.

### 2. Potential contributions from CARTIF

CARTIF can contribute in the following areas:

#### a) AI agents for autonomous and collaborative decision-making

- Development of an **AI agent framework** for dynamic management of AI agents applied to **robotics perception and reasoning**.
- Improvement of **planning, optimization, and lifelong learning** to enhance adaptability and continuous self-improvement of agents (*on-the-fly reasoning*).
- Design and implementation of **multi-agent collaboration frameworks**, ensuring decentralized learning and coordination between distributed systems.

#### b) Integration and validation in experimental environments

- Utilization of **CARTIF's FIWARE iHub**, a facility specialized in **human–robot collaborative environments**, as a **Testing and Experimentation Facility (TEF)** to validate AI agent systems up to TRL 4–5.
- Adaptation and deployment of **multi-agent architectures** already tested in **CARTIFactory** to new frameworks such as **LangChain, CrewAI, and MCP**.
- Integration of **self-developed tools and APIs** for dynamic task execution, ensuring efficient and reliable interaction between multiple AI agents.

#### c) AI model improvement and data integration

- Connection to **AI-on-Demand** and **Data Labs** to share and reuse assets, promoting open innovation and interoperability.

- Link with **Manufacturing Data Spaces** and the **AI Factories** to ensure that developed solutions contribute to the **ApplyAI strategy** and European AI ecosystem.

### 3. Target industrial sectors

CARTIF's experience and infrastructure are relevant for multiple **ApplyAI sectors**, including:

- **Manufacturing and robotics**, focusing on adaptive automation and collaborative systems.
- **Healthcare and pharmaceuticals**, applying autonomous agents for process optimization and predictive control.
- **Agri-food and construction**, using multi-agent coordination for planning, inspection, and resource optimization.
- **Cultural and creative sectors**, exploring AI-driven perception and interaction systems.

### 4. Potential CARTIF roles

- **Technical leader** for AI agent frameworks and multi-agent coordination strategies.
- **Work package leader** for experimental validation of AI systems in FIWARE-based collaborative environments.
- **Contributor** to AI-on-Demand, AI Factories, and Data Spaces for integration, validation, and open data sharing.
- **Liaison** between industrial partners and AI research communities to align developments with the European **ApplyAI strategy**.