coppilot

OPEN CALL #1

TECHNICAL GUIDELINES CL3A INFORMATION

Revision: V1

COVER PAGE

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1 CLUSTER 3A: AGRITECH TRANSFORMATION AND SUSTAINABILITY INITIATIVE (ATSI)

1.1 CLUSTER OVERVIEW

Cluster Title	**Cluster 3A: AgriTech Transformation and Sustainability Initiative (ATSI)**
Domain	Smart Agriculture and Sustainable Food Systems
Locations	Greece
Objective	To create an integrated, data-driven, and interoperable farming ecosystem that leverages AI, robotics, IoT, and blockchain to enhance the productivity, sustainability, and traceability of leafy vegetable production.

The **Cluster3A** pilot activities focuses on fostering interoperability and seamless data sharing across the agricultural value chain, enhancing the integration of edge processing, IoT and robotics to boost farming operations, supporting sustainable production of leafy vegetables to meet market and health demands, and propel the European agricultural sector towards economic growth and competitiveness. ATSI specifically targets the leafy vegetables sector, leveraging a suite of advanced technologies for real-time crop monitoring, pest management, and targeted interventions. This includes deploying IoT sensor networks and utilising drones (UAVs) and Agrirobots (UGVs) for environmental and crop health monitoring. A significant component of ATSI is the enhancement of Just-In-Time (JIT) logistics and smart supply chain management, utilising advanced tracking, routing optimization, and blockchain for ensuring the timely and efficient transport of products. Additionally, ATSI emphasises the importance of data management through the development of a multi-cloud orchestration platform and data lake, facilitating seamless integration and analytics across diverse agricultural data sources.

The **Cluster 3A (ATSI)** pilot activities, bring together four interconnected **Use Cases (UC #3A.1 – #3A.4; see figure below)** that collectively demonstrate a fully digital, interoperable, and sustainable production system for **leafy vegetables**.

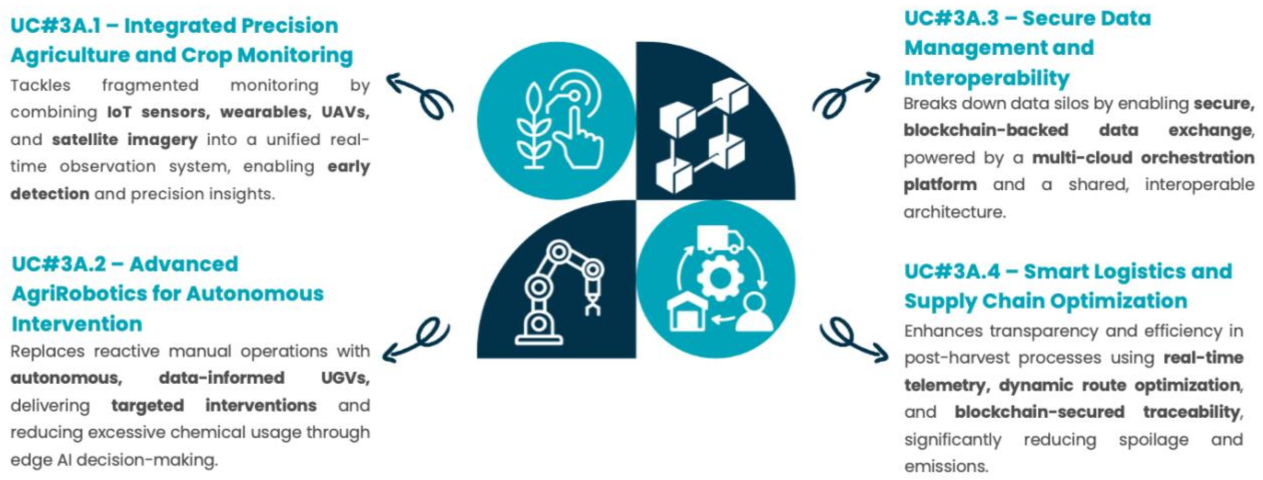

Figure 1- Cluster 3A Use Cases breakdown.

Together, these use cases drive ATSI's overarching mission: **to shift agriculture from fragmented, reactive operations to a real-time, predictive, and transparent value chain**, boosting yield, sustainability, and competitiveness across the European leafy-vegetable sector.

1.2 AVAILABLE INFRASTRUCTURE & TECHNICAL CAPABILITIES

To operationalize the Cluster3A activities and ATSI, the COP-PILOT architecture establishes a fully connected digital ecosystem linking **field operations, processing units, logistics, and retail**. The following figure illustrates how **IoT sensing, edge AI, robotics, 5G connectivity, and blockchain** are integrated through a **Secure Integration Fabric (SIF)** and **multi-cloud orchestration**, enabling real-time coordination, data sharing, and traceability across all stages of leafy-vegetable production—from **farm to fork**.

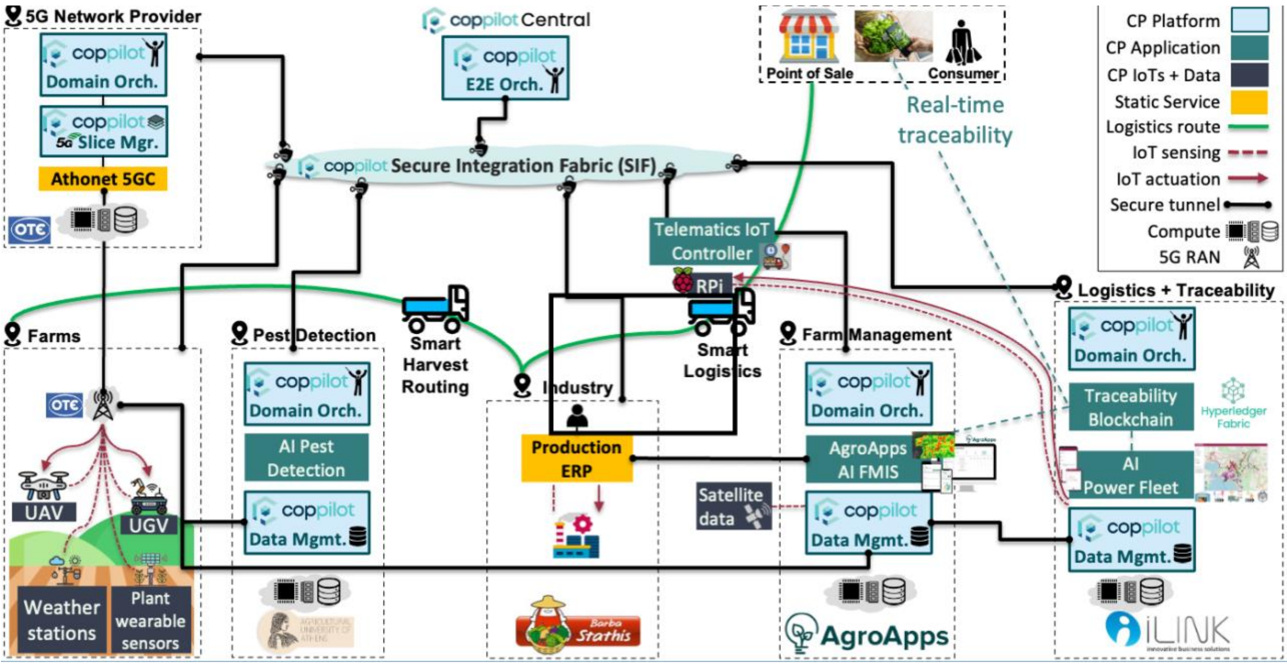

Figure 2- Cluster 3A – ATSI end-to-end architecture.

Cluster 3A includes the following domains:

- 5G Network domain
- Farm domain
- Pest Detection domain
- Industry domain
- Farm Management domain
- Logistics & Traceability domain
- Smart Logistics (moving domain)

For each of the domains, we list below the current infrastructure components and their availability to be utilized by applicants.

Table 1: Infrastructure components provided by the Cluster 3A Farm Management domain.

Infrastructure type	Description
Physical compute infrastructure	1x Dell server XYZ model with Intel Xeon model XYZ clocked at 1.5 GHz, DDR4 64 GB RAM, 1TB SSD
Virtual compute infrastructure	1x VM with: • 12 vCPUs

	- 64 GB RAM - 45 GB Storage - 1x physical network interface to provide Internet access to this VM where a K3S cluster is setup to host: - ETSI OpenSlice (COP-PILOT Domain Orchestrator component) - FIWARE Orion-LD Context Broker (COP-PILOT Data Management component) - The necessary Cluster3A applications for this domain (to be provisioned by the COP-PILOT orchestrators)
Physical network infrastructure	Dedicated switches/routers: N/A Dedicated 5G components: N/A This domain communicates with: - The production ERP system of the “Industry” domain - The Data Management component of the “Pest Detection” domain - The Data Management component of the “Logistics & Traceability” domain This communication takes place via COP-PILOT’s Secure Integration Fabric via private secure tunnels. This domain exposes a public endpoint where the AgroApps dashboard is hosted to the Farm Management stakeholders. No 5G infrastructure is provided by this domain.
Virtual network infrastructure	N/A
Physical IoT infrastructure (or data sources)	N/A
Virtual IoT infrastructure (or data sources)	N/A
Infrastructure Availability for COP-	This infrastructure is fully available for COP-PILOT to deploy necessary platform and application component for the validation of Cluster3A and

PILOT and Open Calls	potential Open Call projects to be integrated with this cluster in the near future.

Table 2: Infrastructure components provided by the Cluster 3A Pest Detection domain.

Infrastructure type	Description
Physical compute infrastructure	AMD CPU with 16 cores,62 GB RAM and 1TB SSD storage.
Virtual compute infrastructure	1x VM with: • 16 vCPUs • 62 GB RAM • 45 GB Storage • 1x physical network interface to provide Internet access to this VM where a K3S cluster is setup to host: • ETSI OpenSlice (COP-PILOT Domain Orchestrator component) • FIWARE Orion-LD Context Broker (COP-PILOT Data Management component) • The necessary Cluster3A applications for this domain (to be provisioned by the COP-PILOT orchestrators)
Physical network infrastructure	Dedicated switches/routers: 4g router so the robot will communicate with the main server Dedicated 5G components: N/A at the moment This domain exposes a public endpoint so the project servers can communicate with the AUA server No 5G infrastructure is provided by this domain.
Virtual network infrastructure	N/A

Physical IoT infrastructure (or data sources)	Bashler RGB camera FHD
Virtual IoT infrastructure (or data sources)	N/A
Infrastructure Availability for COP-PILOT and Open Calls	This infrastructure is fully available for COP-PILOT to deploy necessary platform and application component for the validation of Cluster3A and potential Open Call projects to be integrated with this cluster in the near future.

Table 3: Infrastructure components provided by the Cluster 3A Logistics & Traceability domain.

Infrastructure type	Description
Physical compute infrastructure	1× primary server at the iLINK data centre hosting the Logistics & Traceability platform: • Intel Xeon class CPU with 16 physical cores (32 threads) • 64 GB DDR4 RAM • 2 TB NVMe SSD for ledger data and databases • Ubuntu Server 22.04 LTS, Docker / Kubernetes runtime 1× secondary server for high availability / backups of the traceability services: • 8 cores, 32 GB RAM, 1 TB SSD • Same OS and container stack as the primary node
Virtual compute infrastructure	Virtualised environment (K8S / Kubernetes cluster) running on the above servers, providing: • VMs with in total ~24 vCPUs, 64 GB RAM and 2 TB storage for containers • Hyperledger Fabric components (ordering service, peers, CAs) for the ATSI traceability ledger • FIWARE Orion-LD Context Broker for logistics entities and event data • API gateway and microservices

Physical network infrastructure	• Redundant 1 Gbit/s fibre Internet connection with static public IPs for exposing the blockchain and context APIs via secure endpoints • Open Ziti
Virtual network infrastructure	N/A
Physical IoT infrastructure (or data sources)	• 4 edge devices for tracking and data collection. • 2 edge devices for Temperature / humidity and loading docks whose data is forwarded.
Virtual IoT infrastructure (or data sources)	N/A
Infrastructure Availability for COP-PILOT and Open Calls	This infrastructure is fully available for COP-PILOT to host the core Logistics & Traceability services (Hyperledger Fabric ledger, FIWARE Orion-LD, telemetry ingestion and APIs)

Table 4: Infrastructure components provided by the Cluster 3A 5G Network Provider domain.

Infrastructure type	Description
Physical compute infrastructure	
Virtual compute infrastructure	
Physical network infrastructure	
Virtual network infrastructure	
Physical IoT infrastructure (or data sources)	
Virtual IoT infrastructure (or data sources)	
Infrastructure Availability for COP-PILOT and Open Calls	The available infrastructure includes a 5G SA end-to-end network, including RAN, 5G Core and cloud infrastructure supporting services and applications. Within the COP-PILOT project, the infrastructure will be extended with access network deployment in the field. The network is designed to support low latency, high throughput and

	network slicing capabilities. Network slicing will be enabled following the integration with the Open Slice component, as defined in the COP-PILOT architecture.

Figure 2 illustrates the end-to-end architecture of the Cluster 3A – AgriTech Transformation and Sustainability Initiative (ATSI), demonstrating how distributed technologies operate in unison across the leafy-vegetable value chain. The system connects IoT sensing (weather stations, UAVs, UGVs, and plant wearables) with AI-powered pest detection and farm management platforms, coordinated through 5G-enabled edge domains and a Secure Integration Fabric (SIF).

At the **data layer,** a multi-cloud orchestration environment supports real-time analytics and interoperability between farms, industry, and logistics actors. **Blockchain-secured traceability** (Hyperledger Fabric) ensures trusted data exchange and transparent monitoring of each product batch from field to point-of-sale.

Through this architecture, ATSI enables real-time decision-making, targeted interventions, and smart logistics routing, reducing resource waste and emissions while ensuring the freshness, safety, and sustainability of leafy-vegetable production.

The **ATSI testbed** provides access to operational farm plots (spinach crops), IoT sensor networks, 5G connectivity, and the Secure Integration Fabric (SIF) for data exchange. Applicants will receive technical onboarding, data access credentials, and integration support from Cluster3A and COP-PILOT consortium partners during experimentation.

Note for Open Call applicants

Open Call projects interested in Cluster 3A activities have the following integration capabilities:

- Open Call projects may bring and **deploy a new domain** within Cluster 3A, introducing complementary technologies, datasets, or services; or
- They may **host and validate their solution within one of the existing Cluster 3A domains**, leveraging its infrastructure, data environment, and demonstration use cases.

1.3 OPEN CALL CHALLENGES & INNOVATION OPPORTUNITIES

Applicants are expected to propose demonstrators, software modules, or prototype integrations that can be validated in the ATSI testbed within a 6-month timeframe. Proposals should clearly describe the technical innovation, integration approach with existing COP-PILOT and Cluster 3A components (FMIS, SIF, blockchain, or robotics), and expected impacts, demonstrating improvements in efficiency, sustainability, or interoperability.

Solutions are expected to start at a minimum **Technology Readiness Level (TRL) 6** and reach **TRL 7–8** by the end of the project, ensuring deployment-ready maturity and clear validation under real operational conditions.

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The following challenges represent examples of potential topics that applicants may address under **Cluster 3A (ATSI).** Proposals are encouraged to build upon or expand these areas by introducing innovative solutions that enhance system interoperability, digital transformation, and sustainability across the agri-food value chain.

1. Interoperable Plant Sensor Prototypes

Design and validate **leaf-mounted or in-soil sensors** capable of capturing nutrient levels, stress biomarkers, or pesticide residues. Prototypes must integrate with the **COP-PILOT Secure Integration Fabric (SIF)** and existing **plant wearables** to enhance multi-source data fusion, real-time observation, and FMIS analytics for early detection and precision management.

2. Edge-Controlled Smart Irrigation and Microclimate Systems

Develop **AI-enabled irrigation controllers** that operate on the **5G edge network**, receiving crop, weather, and soil data from the ATSI testbed. Systems should dynamically optimize irrigation schedules via FMIS, enabling **closed-loop water management** and supporting sustainability KPIs related to water use efficiency and energy savings.

3. Smart Freshness and Quality Sensors for Packaged Produce

Design and test **sensor-embedded packaging** capable of monitoring freshness indicators (e.g., ethylene, humidity, temperature). Data should feed into **AgroApps' FMIS** and **ILINK's blockchain modules** to enable **end-to-end traceability** and predictive alerts during transport and storage, improving post-harvest logistics and reducing waste.

4. Onboard Tractor and Machinery Activity Logging for FMIS & ISOBUS Integration

Deploy **tractor or implement-mounted IoT units** that interface with the **ISOBUS** to capture operation data such as speed, location, implement type, and task execution. Using **edge-AI processing**, the system will log and synchronize data with **AgroApps' FMIS** and **Hyperledger Fabric traceability modules**, enabling **real-time activity tracking, carbon accounting, and interoperability across machinery brands**.

5. AR/XR Field Decision Support Dashboards

Develop **AR/XR interfaces** that integrate real-time data from the **FMIS, UAV/UGV missions, and plant sensors**. The interface should support agronomists in visualizing crop stress areas, managing interventions, and coordinating multi-agent operations in the field, demonstrating the power of **data-driven situational awareness** and collaborative decision-making.

6. Robotic Solutions for Automated Cultivation Practices

Develop or integrate UGV-based or robotic-arm systems capable of autonomously performing key field operations—such as weeding, thinning, targeted spraying, or selective harvesting—in spinach and other leafy-vegetable crops. Solutions should demonstrate reliable navigation within dense crop rows, AI-based perception for canopy analysis, and gentle manipulation mechanisms to ensure crop integrity. All robotic systems must connect to the ATSI 5G testbed and Secure Integration Fabric (SIF) for task scheduling, remote control, and data synchronization with the FMIS.

Every proposal submitted to Cluster 3A (ATSI), whether addressing one of the listed challenges or introducing a novel idea, must clearly define its strategy and demonstrate how it will achieve measurable impact in one or more of the following dimensions, in alignment with COP-PILOT's overarching goals of digital transformation, sustainability, and competitiveness in the agri-food sector:

- **Environmental Impact:** Reduction of resource use and emissions through data-driven and precision operations—e.g., decreased water consumption, fertiliser and pesticide inputs, and CO_2 emissions across cultivation and logistics activities.
- **Economic Impact:** Increased productivity and cost efficiency at farm and supply-chain level, improving resilience and profitability of leafy-vegetable production while fostering uptake of advanced digital solutions by SMEs.
- **Technological Impact:** Advancement of interoperability, edge-AI, robotics, IoT, and blockchain integration within a real-time agricultural data ecosystem, raising technology maturity towards TRL 7–8.
- **Societal Impact:** Enhanced food safety, traceability, and consumer trust through transparent data flows from field to fork, alongside improved working conditions and digital skills for agricultural operators.
- **Replication and Scalability:** Demonstrated potential for cross-sector and cross-crop deployment beyond spinach and leafy vegetables, enabling transferability of results to other European regions and high-value horticultural chains.

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