Ref. Ares(2025)11347789 - 18/12/2025

MYMATCH

Deliverable 3.3

AI Platform architecture & requirements manual

Nature of the deliverable		
R	Document, report	X
DEM	Demonstrator, pilot, prototype	
DMP	Data Management Plan	
OTHER	Software, technical diagram, etc	

Dissemination level		
PU	Public (*fully open*)	X
SEN	Sensitive (*limited under the conditions of the Grant Agreement*)	
EU CI	EU Classified (*eu-restricted, eu-confidential, eu-secret under Decision 2015/444*)	

Deliverable No.	D3.3
Dissemination level	PU
Work Package	WP3
Task	Task 3.3
Lead beneficiary	EXUS
Contributing beneficiaries	CNR
Main authors	Konstantinos Kalampokis (EXUS), Alex Ciobanu (EXUS), Madalin Pinzaru (EXUS), Pedro López (EXUS), Edmondo Di Giuseppe, Leandro Rocchi (CNR), Marco Simonetti (CNR), Piero Toscano (CNR)
Due date of deliverable	31.12.2025 (M13)
Actual submission date	18.12.2025 (M13)

Quality procedure			
Date	Version	Reviewers	Comments
30.11.2025	V1	Massimiliano Pasqui (CNR)	Answer to questions on the deliverables review process and Review dates
11.12.2025	V2	All partners	Review and update
13.12.2025	V3	Paola Battilani (UCSC)	Review and minor changes suggested, text update
17.12.2025	V4	Ethical advisor	Review and minor changes suggested, text update

18.12.2025	V5	Konstantinos Kalampokis (EXUS), Alex Ciobanu (EXUS), Madalin Pinzaru (EXUS), Pedro López (EXUS), Edmondo Di Giuseppe, Leandro Rocchi (CNR), Marco Simonetti (CNR), Piero Toscano (CNR)	Final check before submission.

Acknowledgements

This report is part of the deliverables from the project MYMATCH, which has received funding from the European Union's Horizon Europe research and innovation program under grant agreement N° 101181208. More information on the project can be found at www.mymatch-project.eu.

Document's objective and executive summary

This deliverable presents the full architecture, technical specifications, system requirements, preliminary deployment considerations, and governance elements defining the MYMATCH AI Platform, developed under Task 3.3. All deployment requirements and prerequisites are defined herein, while the full operational deployment, the system integrations, and the user-facing workflows will be executed and documented under WP8. The platform integrates heterogeneous datasets, predictive models, climate projections, fungal ecology, and mycotoxin monitoring workflows into a unified digital ecosystem supporting scenario simulation, risk assessment, and decision-making. The document describes in detail:

- the co-design methodology involving WP3, WP4, WP5, WP6, WP7 and WP8;
- the conceptual, logical, functional, and technical architecture;
- the data architecture and end-to-end data flows;
- the AI components and governance framework;
- the security model and threat assessment;
- the DSS operational workflows and integration with AgroSat;
- interoperability standards and compliance mechanisms;
- the initial requirements catalogue (functional and non-functional).

At this stage, the requirements included in this deliverable reflect only the co-design activities performed with the project partners. The requirements from end users (farmers, policymakers and decision makers) are not yet available, as they will be co-defined together with SAB end users during a dedicated SAB workshop. The outcomes of the SAB workshop will be analysed, consolidated and integrated into the complete requirements framework. Therefore, the present deliverable includes only the partner-defined requirements, while the full set of end-user requirements will be available once the SAB consultation process has been completed. Regardless of the current availability of end-user requirements, the architecture has been conceived to allow seamless extension and refinement as new datasets, modelling components and user-derived insights emerge over the course of the MYMATCH project.

Contents

List of abbreviations

Abbreviation	Full Term
AI	Artificial Intelligence
API	Application Programming Interface
CSV	Comma-Separated Values
DSS	Decision Support System
EFSA	European Food Safety Authority
ERP	Enterprise Resource Planning
EU	European Union
FAIR	Findable, Accessible, Interoperable, Reusable
FR	Functional Requirement
FS4EU	FoodSafety4EU
GDPR	General Data Protection Regulation
GeoJSON	Geographic JSON
GIS	Geographic Information System
GUI	Graphical User Interface
HTTPS	Hypertext Transfer Protocol Secure
INSPIRE	Infrastructure for Spatial Information in Europe
ISO	International Organization for Standardization
J2EE	Java 2 Platform Enterprise Edition
JSON	JavaScript Object Notation
JWT	JSON Web Token
NetCDF	Network Common Data Form

Abbreviation	Full Term
NFR	Non-Functional Requirement
OGC	Open Geospatial Consortium
OAuth2.0	Open Authorization 2.0
PostgreSQL	PostgreSQL Database
PostGIS	PostGIS Spatial Extension
RBAC	Role-Based Access Control
REST	Representational State Transfer
SAB	Stakeholder Advisory Board
UI	User Interface
WP	Work Package

1. Introduction

The MYMATCH platform is designed to support European research, regulatory and agricultural stakeholders in assessing fungal and mycotoxin risks under evolving climatic conditions. It integrates datasets from WP4–WP7, predictive modelling workflows from WP8, and co-design principles from WP9 into a single, robust technological infrastructure.

The objective of D3.3 is to document the architecture that will guide development and implementation during WP8, ensuring scientific soundness, technical feasibility, interoperability, and compliance with FAIR principles. Because the deliverable is public (PU), it adopts a technical-but-readable style suitable for multidisciplinary audiences.

This document reflects the current maturity of the system design and forms the baseline upon which subsequent implementation, integration, testing, and refinement activities will build.

1.1 User-Centered Design Foundation

As it was mentioned on the Executive Summary, at this stage, the requirements included in this deliverable reflect only the co-design activities performed with the project partners as this is documented on D3.2. Key stakeholder personas and their primary needs have directly informed the platform's design principles, functional capabilities, and user interface requirements.

The user requirements documented in D3.2 include the following key stakeholders:

- **Farmers** (Persona: ANYS_01): Medium-scale grain producers requiring mobile-friendly optimized solutions with clear visual dashboards, straightforward alerts and practical, field-proven solutions. Primary concerns: testing costs and delays, weather uncertainty, regulatory complexity, and economic pressure.
- **Food Industry Quality Managers** (Persona: ANYS_02): Senior QA professionals requiring customizable dashboards with trend analysis, real-time alerts, desktop interfaces and audit trails. Primary concerns: supply chain complexity, analytical bottlenecks, regulatory variations.
- **Policymakers** (Persona: ANYS_03): European food safety authorities requiring transparent methodologies for policy defense, cross-border data sharing capabilities, customizable dashboards, and desktop interfaces with mobile notifications. Primary concerns: scientific uncertainty, regulatory harmonization, stakeholder divergence.
- **Consumers** (Persona: ANYS_04): Health-conscious individuals requiring mobile-friendly apps with and easy-to-understand information. Primary concerns: information overload, supply chain transparency, food safety.

These personas and requirements have been systematically mapped to the platform's logical architecture (Section 4), technical components (Section 5), and AI governance framework (Section 7) to ensure that design decisions are grounded in real stakeholder needs and use cases.

Following design thinking and co-creation methodologies, we foresee end-users as active participants throughout the development lifecycle, ensuring increased stakeholder acceptance and alignment with operational realities. This user-centric approach is critical for achieving the platform's objectives while help maintaining high stakeholder satisfaction and adoption rates.

2. Methodology for Architecture Co-Design

The architecture of the MYMATCH AI Platform was developed through a structured co-design process that ensured scientific robustness, technological feasibility, and alignment across all relevant Work Packages. The methodology adopted for Task 3.3 followed an iterative, evidence-driven, and multi-actor approach that enabled the integration of heterogeneous requirements, multidisciplinary expertise, and cross-WP interdependencies. The process unfolded through five major phases, each contributing to a progressive refinement of the platform’s conceptual, functional, and technical foundations.

2.1 Requirements Collection and Alignment

The first phase focused on collecting, consolidating, and interpreting the requirements emerging from partners and technical teams across the project. Dedicated sessions, as well as workshop during Consortium Meeting in Braga were conducted to identify functional needs, user expectations, data constraints, and operational priorities. Input was systematically gathered from the scientific and technical activities of WP4, WP5, WP6, and WP7, which provided essential information on:

- Data formats and structures (e.g., climate variables, mycotoxin measurements, fungal ecology datasets, agronomic trials);
- Metadata models and annotation rules, aligned with FAIR and domain-specific standards;
- Experimental protocols, sampling strategies, and laboratory procedures that determine data availability and temporal granularity;
- Pre-processing and harmonisation constraints needed to transform heterogeneous inputs into model-ready formats;
- Technical requirements from WP8, including model parameterisation, input preparation workflows, and simulation dependencies;
- Co-design principles from WP3 and WP9, ensuring that platform interfaces and scenario-building workflows serve diverse user profiles.

The outcome of this phase was a consolidated requirements corpus, forming the foundation for architectural decomposition and guiding all subsequent design decisions.

2.2 System Decomposition

In the second phase, the consortium translated the collected requirements into a structured set of logical modules, enabling clear separation of responsibilities and ensuring that each system function was mapped to explicit architectural components. The MYMATCH platform was decomposed into the following modules:

- Data Integration Module: ingestion, validation, harmonisation, metadata assignment, and storage;
- Scenario Builder Module: visual construction of simulation pipelines and parameter configuration;
- Predictive Modelling Module: execution of mechanistic, statistical, and hybrid models for fungi and mycotoxin dynamics;
- AI Augmentation Module: data gap filling, parameter recommendation, scenario suggestion, and anomaly detection;
- Risk Assessment Module: generation of quantitative indicators, risk curves, maps, and uncertainty layers;
- DSS Module: synthesis of model outputs into actionable recommendations and AgroSat-ready products;
- Visualisation Module: interactive dashboards, spatial layers, temporal charts, and report generation;
- Infrastructure and Service Management Module: computational resources, backup, API orchestration, and authentication systems.

This decomposition created a modular architectural blueprint, enabling independent development, clear interface specification, and robust integration pathways.

2.3 Technology Assessment and Selection

The third phase consisted of a comprehensive assessment of potential technological solutions, guided by criteria such as scalability, robustness, long-term maintainability, FAIR compliance, security, performance, and alignment with EU digital infrastructure standards. Following a systematic evaluation, the consortium selected a technology stack that balances computational efficiency, interoperability, and accessibility:

- **PostgreSQL/PostGIS** for spatially-enabled data management, metadata indexing, and harmonised storage;
- **Python, R, and C/C++ environments** for implementing predictive models and scientific computations;
- **REST API architecture implemented with FastAPI** to ensure modularity, interoperability, and easy integration with external services, including AgroSat;
- Keycloak for authentication mechanisms;

This selection forms a stable technological foundation while ensuring flexibility for future extensions and emerging requirements.

2.4 Iterative Refinement

The architecture evolved through several refinement cycles that involved partners across all WPs. Each iteration focused on integrating feedback, validating assumptions, and resolving technical dependencies. Key refinement activities included:

- Alignment of climate and environmental data pipelines with WP7 requirements;
- Standardisation of metadata fields and harmonisation rules from WP4;
- Incorporation of agronomic and ecological constraints derived from WP5 and WP6;
- Mapping of predictive modelling chains and inter-model dependencies with WP8;
- Adjustment of UI and scenario-building workflows based on WP9 co-design sessions;
- Review of API specifications and service orchestration logic to backend architecture;
- Assessment of impacts on deployment, storage, computational load, and interoperability.

Each refinement cycle improved coherence between data, models, AI components, and user-facing services, ensuring a unified and stable architectural baseline.

2.5 Validation

The final phase validated the architecture against technical, scientific, and regulatory criteria. Validation activities included:

- Technical feasibility checks, assessing computational requirements, scalability, performance constraints, and security risks;
- Integration mapping, ensuring compatibility and data exchange readiness across all modules and WPs;
- FAIR compliance assessment, verifying adherence to metadata standards, transparency requirements, and open data principles;
- INSPIRE conformity checks, ensuring compatibility with EU geospatial data standards;
- Risk assessment, evaluating architectural resilience against data loss, system failures, and security threats.

The validated architecture now serves as the authoritative reference for implementation activities in WP8 and as the structural foundation for future updates.

3. Overall Platform Concept & Vision

The MYMATCH platform is conceived as an integrated, modular, and AI-enhanced digital ecosystem designed to support the prediction, assessment, and management of mycotoxin risks across diverse agricultural and climatic contexts. Its conceptual foundation is built on the need to combine scientific modelling, harmonised data infrastructures, and user-oriented decision-support functionalities into a unified environment capable of informing both operational and policy-level actions. The platform’s long-term vision is to become a robust, transparent, and scientifically validated tool supporting European food safety authorities, researchers, farmers, cooperatives, extension services, and policy stakeholders. This vision responds directly to the challenges posed by climate variability, emerging and/or fluctuating fungal pressures, fragmented data sources, and the increasing need for anticipatory rather than reactive management strategies. Its long-term objectives include:

- **Integrating climate, agronomic, fungal and contamination data** into harmonised, metadata-rich computational workflows that comply with FAIR and INSPIRE principles. This integration allows multi-source datasets to be processed consistently and reused across modelling layers.
- **Running state-of-the-art predictive models** describing fungal development, crop susceptibility, toxin biosynthesis, and environmental interactions. These models combine mechanistic knowledge, empirical evidence, and machine-learning components to improve prediction accuracy and robustness.
- **Simulating alternative climatic, agronomic or management scenarios** through a fully configurable Scenario Builder, enabling users to explore “what-if” situations, assess long-term risks, and test adaptation or mitigation strategies.
- **Generating risk maps, probability curves, confidence bands, thresholds, and mitigation recommendations** through the Decision Support System (DSS), transforming raw model outputs into interpretable and actionable insights.
- **Ensuring transparency, scientific validity, and regulatory acceptability** by adopting explainable modelling principles, traceable data provenance, and suitable documentation to enable regulatory scrutiny and reproducibility.
- **Supporting spatial and temporal intelligence** by integrating with AgroSat, enabling advanced geospatial visualisation and spatial prioritisation of risk and mitigation hotspots.

By design, MYMATCH acts as a bridge between complex scientific modelling and practical risk management needs. The platform ensures that:

- Scientific advances in fungal ecology, climate modelling, and mycotoxin research are computationally exploitable;
- AI methodologies enhance but do not compromise the interpretability of scientific outputs;
- Data heterogeneity is resolved through harmonisation and metadata governance;
- Model results are translated into operational insights that can be readily applied in the field or in policy settings.

The platform ultimately supports a multi-stakeholder ecosystem where researchers can test hypotheses, authorities can track emerging risks, farmers can obtain practical guidance, and policymakers can evaluate long-term climate-driven scenarios.

4. Logical and Functional Architecture

The platform is structured into eight logical layers

User Interface Layer

Interfaces for:

- scenario creation;
- model configuration and execution;
- risk visualisation (maps, curves, uncertainty);
- DSS recommendations

The User Interface Layer accommodates the diverse user profiles identified in Deliverable D3.2. Interface design will be integrated with WP9 validation activities (T9.1, T9.2, T9.3) and documented in D9.1, following a participatory co-design approach that ensures iterative refinement of user experience based on empirical evaluation with representative end-users.

Data Integration Layer

Responsible for ingestion, harmonisation, metadata assignment, quality assurance, and transformation of datasets from WP4, WP5, WP6, WP7, and external providers.

Scenario Builder Layer

A block-based visual environment where users combine modules such as “Weather input”, “Climate Scenario Input”, “Fungal Model”, “Mycotoxin Model”, “Risk Indicator”, etc. AI suggests optimal handling of related situations.

Predictive Modelling Layer

Includes mechanistic, statistical, and hybrid models structured in multi-step modelling chains (crop → fungi → toxin → exposure).

AI Augmentation Layer

Provides data handling, parameter recommendations, scenario suggestions, and anomaly detection.

Risk Assessment Layer

Aggregates model outputs into interpretable risk metrics, including spatial and temporal indicators.

DSS Layer

Generates mitigation measures and high-level recommendations, with integration into AgroSat for visualisation.

Infrastructure Layer

Manages compute resources, servers, backup systems, and service orchestration.

5. Technical Architecture & Deployment

The platform relies on a distributed architecture:

Servers

- **Data Storage Server:** PostgreSQL/PostGIS for structured data and metadata handling.
- **Data Repository Server:** NextCloud for raw and harmonized dataset storage, versioning, and metadata management. WP8 accesses processed data via APIs provided by WP7.
- **Service Management Server:** Python/FastAPI backend, React/TypeScript Frontend, Keycloak authentication services.
- **AI/Model Execution Server:** Python environments for predictive modelling and AI computations.

Containerization

All app components will be containerized with Docker and related tools for stability and compatibility across systems.

Backend Services

APIs built in Python with FastAPI support data ingestion, user management, model execution requests, AI services, and DSS endpoints.

Frontend

A web-based GUI built in React/TypeScript supports scenario creation, model execution monitoring, visual analytics, and DSS presentation.

6. Data Architecture & Data Flows

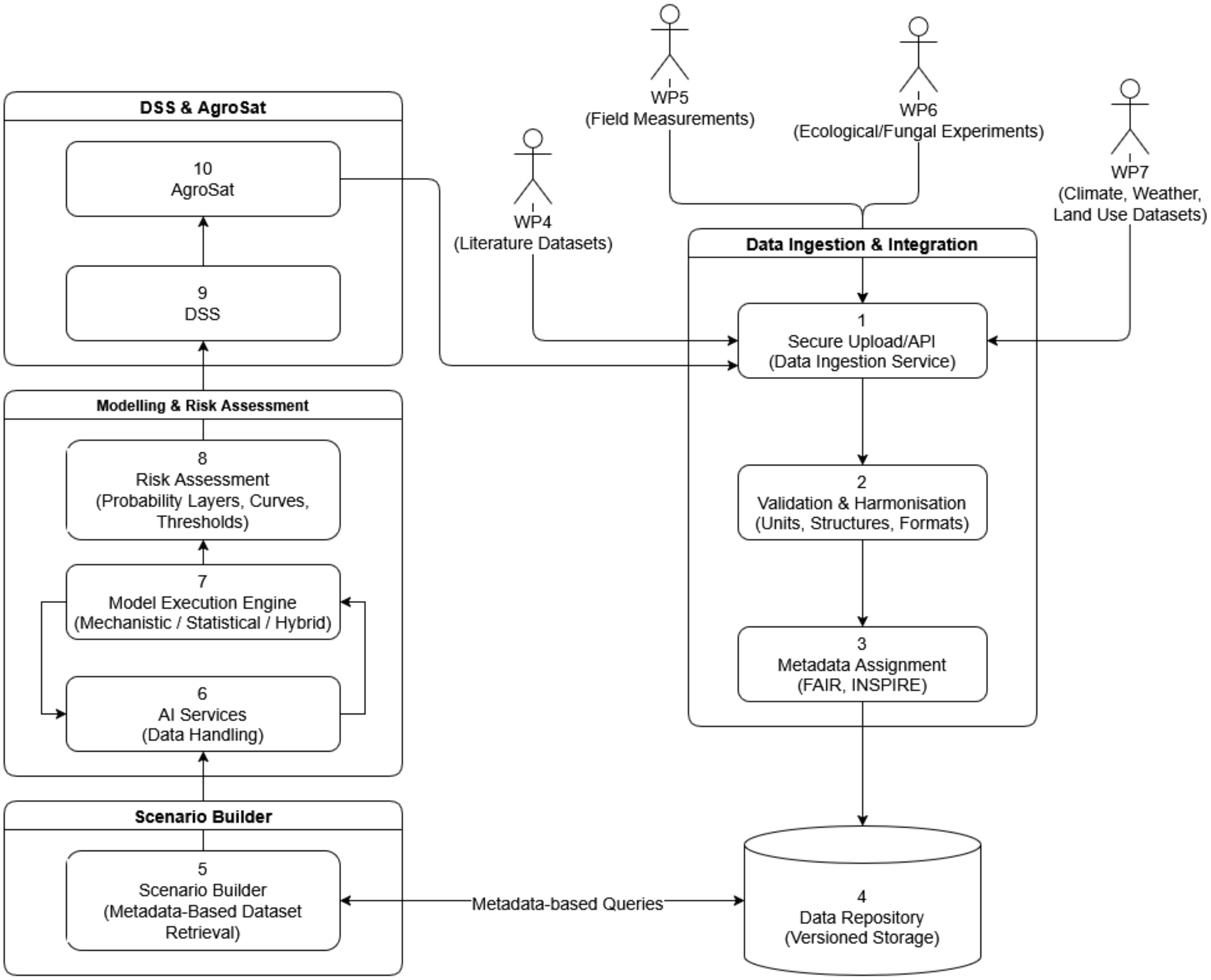
6.1 Data Sources

- WP4: literature-based datasets and metadata.
- WP5: field mycotoxin measurements.
- WP6: ecological/fungal experiments.
- WP7: climate, weather, and land use datasets (see Data Management Plan)
- External: AgroSat, Copernicus, and national monitoring bodies.

6.2 Harmonisation and FAIR Compliance

Data are validated, aligned to shared schemas, enriched with metadata, indexed spatially and temporally, and versioned.

6.3 End-to-End Data Flow



1. **Raw data ingestion** via secure upload or API.
2. **Validation & harmonisation** (units, structures, formats).
3. **Metadata assignment** following FAIR and INSPIRE.
4. **Data Repository** with file-level versioning.
5. **Scenario Builder** → dataset retrieval from Data Repository via metadata queries.
6. **AI Services** for assistance with data handling.
7. **Model execution** engine.
8. **Risk assessment** producing probability layers, curves, thresholds.
9. **DSS synthesis** and export to AgroSat for mapping.
10. **AgroSat** for direct connection to datasets and farm management features.

7. AI Architecture & AI Governance

The MYMATCH platform incorporates a multi-layered AI architecture designed to enhance data quality, support scenario configuration, improve modelling robustness, and strengthen the usability of the system for non-expert users. AI components are deliberately positioned as assistive technologies, complementing mechanistic and statistical models rather than replacing them. This alignment ensures scientific validity, interpretability, and regulatory acceptability. The AI framework is complemented by a robust governance structure designed to guarantee transparency, accountability, auditability, and compliance with emerging EU AI regulations. Together, the architecture and its governance model ensure that AI functionalities within MYMATCH are technically strong, ethically sound, and aligned with standards for trustworthy AI.

7.1 AI Components

The AI architecture is structured around three complementary levels, each targeting specific aspects of data processing, user support or scenario generation.

UI-Level AI

This component enhances user interaction and decision-making efficiency by providing:

- **Parameter recommendations**, inferred from previous user configurations, domain constraints, and historical system usage;
- **smart defaults** that reduce configuration time while remaining scientifically grounded;
- **context-aware suggestions**, adapting to the selected crop, region, climate inputs, or model type.

The goal is to support both expert and non-expert users, lowering the learning curve while maintaining full control and transparency.

Data-Level AI

This AI layer operates on incoming datasets to ensure completeness and coherence. Functionalities include:

- **missing data handling** using statistical or machine-learning-based imputation strategies;
- **denoising and anomaly detection**, identifying potential errors, redundancies, or inconsistencies in data sourced from WP4–WP5-WP6-WP7;
- **synthetic data generation**, especially useful in cases of sparse measurements or incomplete temporal sequences, supporting more robust model inputs;
- **harmonisation assistance**, contributing to uniformity across heterogeneous datasets.

These mechanisms reduce uncertainty and increase the reliability of downstream modelling processes.

Scenario-Level AI

This component augments the Scenario Builder by:

- **suggesting alternative or complementary scenarios**, based on previous simulations, modelling outputs, or domain constraints;
- using a **recommendation engine** that analyses correlations, model behaviours, and climatic patterns to propose “what-if” simulations;
- **supporting users in exploring complex scenarios**, facilitating more comprehensive risk analyses.

This layer helps expand the analytical capabilities of MYMATCH without requiring advanced modelling expertise.

All AI components operate within the GDPR compliance framework established in Deliverable D1.3 (Data Management Plan, WP1, M6, Lead: EQY). As documented in D1.3 Section 7.2, the AI-based risk prediction and decision support tools operate at a crop-system level without individual-level profiling. In accordance with D1.3, no automated decisions are made about participants; recommendations are advisory with human-in-the-loop oversight embedded in all use cases. All data processing, user consent procedures, and data protection measures comply with GDPR principles, with a dedicated Data Protection Officer engaged by UCSC overseeing compliance throughout the project."

7.2 AI Governance

To ensure trustworthiness and scientific integrity, MYMATCH implements a comprehensive AI governance framework aligned with EU guidelines on responsible and transparent artificial intelligence. The framework guarantees:

Transparency and Explainability

All AI-driven suggestions, corrections or reconstructions must be interpretable and accompanied by explanatory metadata describing the underlying logic and assumptions.

Provenance Tracking

Every AI interaction is linked to explicit provenance metadata, enabling reproducibility and the ability to understand how specific outputs were produced.

Version Control and Traceability

All models, algorithms, and AI routines are versioned, with clear records of updates, performance changes, and deployment histories.

Bias Detection and Mitigation

AI components undergo periodic evaluation to detect potential biases linked to data imbalance, geographical variability, or sampling distortions. Corrective mechanisms are applied when necessary.

Auditability

Logs and audit trails allow verification of AI-based decisions, ensuring compliance with scientific and regulatory requirements.

Uncertainty Disclosure

Where AI contributes to data reconstruction or scenario generation, uncertainty estimates or confidence intervals must be provided to avoid misinterpretation.

Compliance with EU AI Regulatory Guidelines

The governance framework anticipates the European AI Act by ensuring robustness, risk awareness, transparency, human oversight, and adherence to domain-specific constraints relevant to food safety and environmental modelling. Since the AI system is not intended to produce automated decision-making processes that may impact the fundamental rights and freedoms of the interested parties, it does not constitute a high-risk system.

7.3 Responsible AI Framework and Governance Implementation

Despite the added value that artificial intelligence brings to the MYMATCH platform, the consortium acknowledges the technical, scientific, and ethical limitations associated with AI-driven functionalities. This section clarifies the boundaries within which AI is deployed, ensuring that expectations remain realistic and that human oversight remains central to the system's operation.

7.3.1 Scientific and Technical Limitations

AI components in MYMATCH operate under constraints linked to data availability, representativeness, and uncertainty.

- *Dependence on data completeness and quality*:

  AI-driven imputation, reconstruction, or suggestions rely on patterns present in the training data. Sparse datasets, geographical imbalances, or inconsistent sampling frequency may limit performance.

- *Model generalisation limits:*

  AI routines cannot fully capture rare events, extreme climatic conditions, or novel fungal dynamics not represented in historical datasets.

- *Uncertainty propagation:*

AI-generated outputs introduce additional uncertainty layers that must be communicated transparently and not interpreted as deterministic results.

- *Non-substitutive role:*

AI does not replace mechanistic knowledge, experimental evidence, or expert interpretation. It complements and augments traditional modelling approaches.

7.3.2 Ethical and Regulatory Considerations

The deployment of AI in risk assessment contexts requires adherence to ethical principles and regulatory expectations.

- *Human-in-the-loop oversight:*

AI suggestions and reconstructions are meant to support, not automate, expert decisions. Users retain full control over scenario configurations and interpretations.

- *Avoidance of over-reliance:*

Users must be aware that AI outputs should not be considered authoritative without validation from domain experts, especially in high-impact regulatory or policy contexts.

- *Transparency towards end-users:*

AI contributions must be clearly identified in the platform interface and documentation so that users understand where and how AI intervenes.

- *Compliance with EU food safety and AI regulations:*

The platform aligns with emerging requirements under the EU AI Act, EFSA data transparency principles, and Horizon Europe ethical guidelines.

7.3.3 Responsible Use in the MYMATCH Context

The consortium adopts a responsible use framework with the following commitments:

- AI outputs are always accompanied by metadata describing their origin, uncertainty, and methodological assumptions.
- Users are informed of AI limitations through documentation, tooltips, and user guidance embedded in the platform interface.
- Mechanistic and statistical models remain primary drivers of scientific predictions. AI serves as an enhancer, not a core decision-maker.
- Continuous monitoring of AI performance is carried out to ensure reliability across different crops, climatic regions and modelling scenarios.
- Any updates, retraining or major changes to AI components follow a documented governance process with traceability and validation steps.

8. Security Architecture & Threat Model

8.1 Security Architecture

- OAuth2.0 authentication
- JWT-based session management
- Role-Based Access Control (RBAC)
- HTTPS encrypted channels
- PostgreSQL permissions and low-level access policies
- Container isolation for modelling environments

8.2 Threat Model

Threat vectors include:

- credential compromise
- API abuse and injection
- data corruption and model poisoning
- adversarial data manipulation
- unauthorised scenario execution
- web session hijacking

Mitigation measures include payload validation, rate limiting, input filtering, anomaly detection, secure logging, and model integrity verification.

9. DSS Operational Workflows

DSS workflows transform model outputs into actionable recommendations:

1. **Hazard identification** (fungal species, toxin type).
2. **Risk scoring** (likelihood × severity).
3. **Threshold assignment** based on regulatory and scientific benchmarks.
4. **Spatial aggregation** using geostatistical techniques.
5. **Temporal trend analysis** under climate drivers.
6. **Uncertainty overlaying** (probabilistic envelopes, variability).
7. **Mitigation options generation** (crop management, harvest timing, storage strategies).

10. Interoperability Framework & Standards Catalogue

10.1 Interoperability Framework

Ensures compatibility with:

- FS4EU platform
- AgroSat platform
- Copernicus datasets

- EFSA data exchange guidelines
- EU open data infrastructures

10.2 Standards Catalogue

The platform supports:

- **FAIR** data principles
- **INSPIRE** geospatial metadata
- **ISO 19115** metadata standards
- **OGC API** specifications
- **GeoJSON/JSON**, **NetCDF**, **CSV**
- harmonised semantic vocabularies and controlled terminologies for crops, fungi, toxins, climate and land use

11. Requirements Manual

11.1 Functional Requirements (FR)

- **FR1:** The system shall support structured scenario creation.
- **FR2:** The system shall integrate datasets from WP4–WP7 and external sources.
- **FR3:** The modelling engine shall run multi-layer predictive chains.
- **FR4:** AI components shall enhance data quality and scenario design.
- **FR5:** The DSS shall generate actionable risk mitigation measures.
- **FR6:** The UI shall support interactive visualisation of results.
- **FR7:** APIs shall provide programmatic access for external tools (FS4EU, AgroSat).

11.2Non-Functional Requirements (NFR)

- **NFR1:** FAIR-compliant data architecture.
- **NFR2:** ≥99% system availability.
- **NFR3:** Secure authentication and authorisation.
- **NFR4:** Scalable infrastructure capable of handling increasing data volumes.
- **NFR5:** Transparent and auditable AI workflows.
- **NFR6:** Interoperability with EU standards and platforms.

11.3 Requirements Traceability: D3.2 to D3.3

A comprehensive mapping between D3.2 stakeholder requirements and D3.3 architectural components ensures that platform development remains aligned with user needs throughout implementation:

Stakeholder Persona	Key Requirement)	D3.3 Architectural Response	Implementation Layer
Farmer	Mobile-responsive interface	User Interface Layer – Responsive dashboards;	Frontend & Infrastructure

Farmer	Real-time weather data and alerts	Data Integration Layer – Weather API ingestion; DSS Layer – Alert generation	Data & DSS
Farmer	Low-cost on-farm testing support	Data Integration – Rapid screening data formats; AI Augmentation – Data quality enhancement	Data & AI
Farmer	Peer-to-peer advice, field-proven solutions	UI Layer – Community features	Frontend
Industry QA	Customizable dashboards with trend analysis	UI Layer – Advanced desktop analytics; Risk Assessment Layer – Trend visualization	Frontend & Risk
Industry QA	Real-time contamination alerts	DSS Layer – Alert generation; Data Integration Layer	Data & DSS
Industry QA	Audit trail and traceability	Infrastructure Layer – Comprehensive logging;	Infrastructure & AI
Industry QA	Integration with ERP systems	Infrastructure Layer – API services;	Infrastructure & Interop
Policymaker	Cross-border data harmonization	Data Integration	Data & Interop
Policymaker	Long-term climate scenario analysis	Predictive Modelling – Climate projections; Scenario Builder	Modeling & UI
Policymaker	Evidence-based risk assessment	Risk Assessment – Probability modeling;	Risk & AI
Policymaker	GDPR-compliant sharing	Security Architecture	Security & Infrastructure
Consumer	Mobile-friendly responsive portal	UI Layer – Responsive portal,	Frontend
Consumer	Easy-to-understand food safety information	UI Layer – Plain-language, accessible graphics	Frontend

12. Conclusions & Next Steps

The definition of the MYMATCH AI Platform architecture and requirements manual represents a critical foundation for the platform's development and future deployment. The co-design process—carried out in close collaboration with stakeholders via the MYMATCH Multi-Actor Framework and the Stakeholder Advisory

Board—has ensured that the architecture reflects real-world needs and priorities across the food system.

Key components such as the AI-driven Scenario Builder, Risk Prediction Module, and Decision Support System have been designed and aligned with the project's overarching objectives: to anticipate climate change-induced mycotoxin risks and support informed, evidence-based decision-making for food system actors.

Looking ahead, the next development steps will focus on:

- Implementing backend services and model integration (WP8), ensuring technical coherence and data interoperability across components.
- Refining the Scenario Builder and Decision Support System (WP8–9) based on continuous stakeholder engagement and pilot feedback, incorporating uncertainty quantification and explainability tools.
- Enhancing platform usability and personalization for diverse user groups such as farmers, food processors, and policymakers.
- Expanding support for visual analytics and tailored recommendations, drawing on WP7 outputs and aligned with FAIR data principles.
- Validating outputs through case studies and end-user pilots.

The architecture has been designed in a modular way to support evolution throughout the project as new datasets, models, and user insights emerge, enabling seamless adaptation to need arising from feedback and testing. Feedback from demonstration activities, stakeholder workshops, and end-user testing will inform further iterations, ensuring the platform's relevance and scientific robustness.