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HOLiFOOD Living Labs

Cross-Fertilization Pathways Towards the White Paper

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Living Labs: objectives, approach and methodology

Objectives

HOLiFOOD Living Labs aim to **bridge the gap between research and practice** by facilitating stakeholder dialogue and integrating the **Multi-Actor Approach (MAA) into HOLiFOOD activities**.

Living Labs (LLs) offer a collaborative space to address complex food safety challenges from a systemic perspective, acting as a **catalyst for co-creation.**

- **LL1** & **LL3**: development of methods, tools, and approaches for early warning and the identification of emerging risks.
- **LL2:** development of holistic risk assessment methods and tools to support regulation in an evolving global context.

LLs approach and structure

The LLs operated both at vertical level and at horizontal level:

Living Lab #1: AI-driven Emerging Risk Identification
Creating cutting-edge tools for detecting emerging food safety risks

Living Lab #2: Holistic Risk Assessment
Investigate “omics” techniques for assessing chemical and microbiological food hazards in cereal, legume, and poultry supply chains, ensuring comprehensive food safety solutions.

Living Lab #3: AI-driven Digital Platforms
Engage in the creation of state-of-the-art infrastructure and user interfaces, empowering AI to identify emerging food safety risks effectively.

Cross-fertilitazion workshops & Informal meetings

LLs phases and roles

Each HOLiFOOD LLs follows the “innovation development” phases approach:

EXPLORATION PHASE
priority- setting within each LL as a basis for the setup of the action plan

→

EXPERIMENTATION PHASE
action plan is discussed and verified; mid-term results are monitored and evaluated.

→

EVALUATION PHASE
the output of the LL process is evaluated, and recommendations for further exploitation are developed.

HOLiFOOD LLs roles

LL MANAGER
puts together the LL team and stakeholder group and runs the workshops

LL FACILITATORS
leads workshops, fosters team building; facilitates group dynamics and steers discussions.

LL MEMBERS
representing in a balanced way the actors operating in the food safety risk sector.

Phase I - Exploration

WP	LL title	Content
WP1	Methods and data sources for emerging risk identification: Verification and prioritization	Identification of needs of stakeholders as related to emerging risk identification (ERI) models and tools.
WP3	Inductive research using Delphi as both scoping and data gathering exercise	A Delphi survey was conducted, focusing on the identification of stakeholder's expectations in term of holistic risk assessment dimensions, preferential methods of risk aggregation, and formats of holistic assessment outputs.
WP6	Novel Digital Infrastructure for Food Safety	Identification of technical requirements of stakeholders related to the ERI infrastructures, in terms of data, models and computation.

Phase II - Experimentation

WP	LL title	Focus
WP1	**From Data to Decisions: Shape Food Safety Risk Detection with our Developers**	Stakeholders explored and tested the various tools integrated into HOLiFOOD's interactive dashboard (weak signal miner, topic modelling, and machine learning classification for supply chain analysis) and provided feedback to support the tools' ongoing development.
WP3	**Multicriteria weighting activity**	Stakeholders assessed the weighting of key dimensions within the lentil and poultry supply chains, determining the relative importance of various criteria and exploring potential future scenarios that may impact them.
WP6	**AI for risk prevention**	Stakeholders engaged with AI-driven risk forecasting platforms and provided critical feedback on various aspects of the HOLiFOOD platform.

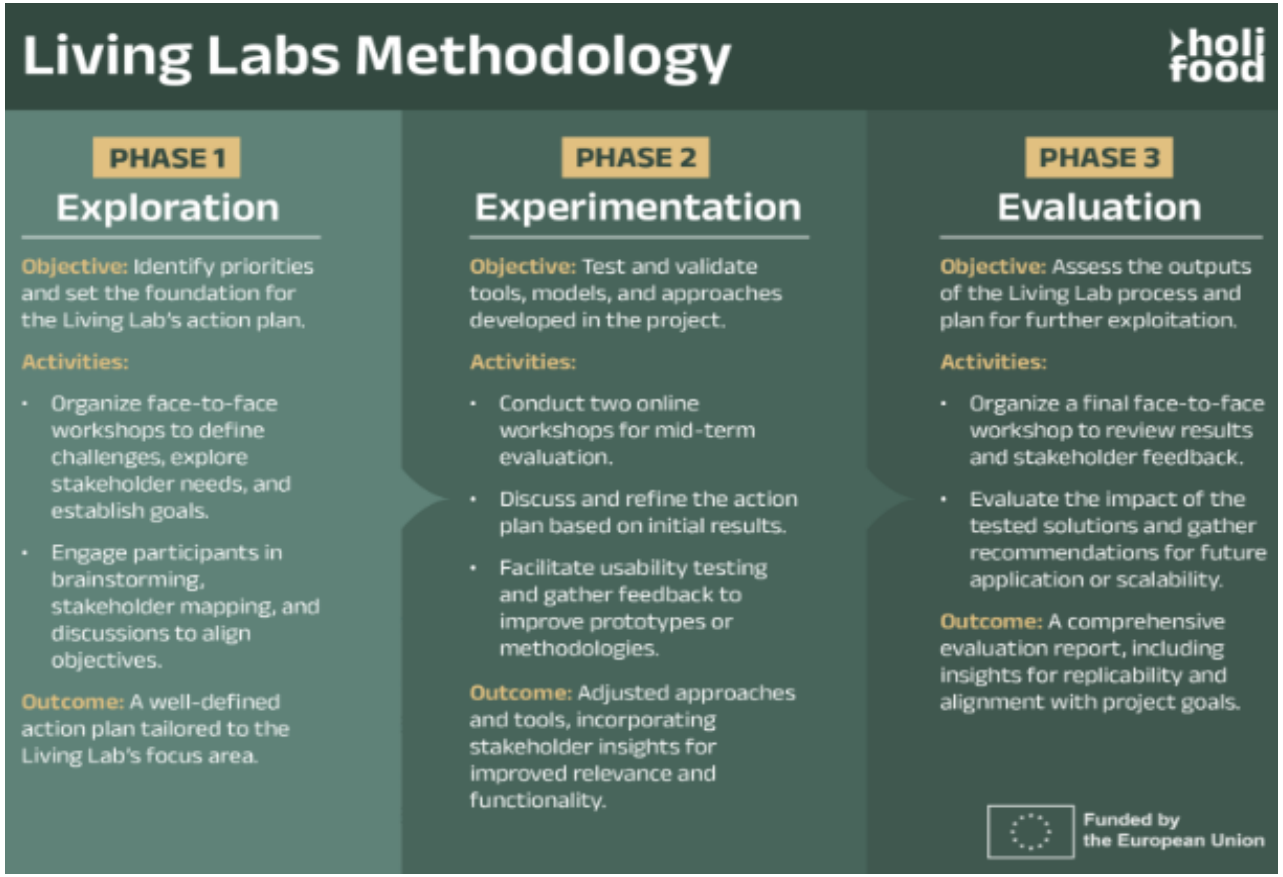
Phase III - Evaluation

WP	LL title	Focus
WP1+ WP6	**Refining the Future of Food Safety - Evaluation & Exploitation Workshop**	Stakeholders navigated the HOLiFOOD dashboard and evaluated its usability, providing feedback to ensure that it meets users' needs and remains relevant, and sustainable beyond the duration of the project.
WP3	**Resilient value chains - Holistic risk assessment in the era of climate Change**	Stakeholders evaluated the holistic risk assessment of the lentil and poultry value chains developed in HOLiFOOD. Microbiological, chemical, nutritional, economic, and environmental risks were analysed through interactive exercises.

LLs Challenges and solutions

Stakeholder fatigue and the **need to re-engage participants**

- ✓ Infographics were created to provide **updates** on the project's progress over the past year and inform potential LL participants about upcoming activities.
- ✓ The last round was organized **within the final event** to increase participation
- ✓ Events were advertised on the HOLiFOOD website and social media channels → **keep engagement high!**



Infographic on the LL methodology

Communication strategy

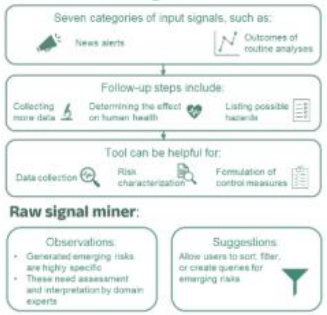
Living Lab #1 – Identification and monitoring of food safety risks

Experimentation phase I workshop - summary

On June 17th 2024, 27 participants attended the first online experimentation workshop. Many expertises including food safety research, risk assessment, risk management, risk communication and tech companies were represented. We presented the currently under development tools (including prediction modeling, weak signal miner, and topic modeling) and asked the participants for feedback on different aspects. Specific goals for each tool are depicted on the right. We used Miro and online forms to gather feedback.

Experimentation phase I - results

Prediction modeling:



Raw signal miner:

Topic modeling:

Stakeholder & Project Team: what can we achieve together?

- Our stakeholders taught us how the tools would be used in practice and what information should be changed or added
- Based on this feedback, we further developed the models and tools
- This allows us to co-create the functionality of the dashboard together

What happens next?

During the next Living Lab activity, we will test the dashboard with the three different tools with a **test case**, providing an **interactive online workshop** to collect feedback on the usability of the dashboard. We want to evaluate how users would use the tools and learn if they are able to find risks based on multiple observations at the same time.
The workshop will be **online** in **June 2025**. Participants will obtain access to the dashboard and will obtain further **information** after registering for the workshop.

We hope you will join us and further shape our work!

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Living Lab #2 – Holistic risk assessment and acceptance

I experimentation workshop - summary

Through LL2, using the Delphi methodology (2023-2024), we successfully identified:

- **key drivers**
- **potential mitigation strategies against *microbial safety risks* in food supply chain.**

These insights are now being applied to evaluate the 5 dimensions of the lentil and poultry supply chains—nutrition, chemistry, microbiology, environment, and economics. For the maize supply chain, we focus on just 3 dimensions: nutrition, chemistry, and microbiology.

The co-creation process proved essential for designing alternative scenarios to the current situation, with climate change emerging as a crucial driver for all three supply chains.

I experimentation LL - results

The first round of experimentation workshops highlighted the need for **holistic, systems-based risk assessment**. Experts emphasized **links between health, environment, and social inclusion**. Key drivers were also identified like **climate change, consumer demand, and geopolitics**.

They also pointed out major barriers such as **inconsistent regulations and weak enforcement**. Initial insights focused on the **chicken supply chain**, with further analysis planned.

Stakeholder & Project Team: what can we achieve together?

Our collaboration has already led to a **shared understanding of key drivers**, with **climate change emerging as a top priority** across supply chains.

This consensus is the foundation for a truly **holistic evaluation**—one that goes beyond risks to include **health, sustainability, and social impact**.

By joining forces, we can turn insights into action and shape food systems that are not only safer, but also more inclusive and future-proof.

What happens next?

In June 2025, we will hold a workshop where stakeholders will engage in the **co-creation process** to generate **weights for the MCDA** (Multi-Criteria Decision Analysis), which will help aggregate the five key dimensions of the supply chains. This workshop will bring together current Living Lab participants, new ones, and experts in **poultry** and **lentil supply chains**.

Stay tuned for more details and join us!

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Living Lab #3 - Novel digital infrastructure for food safety

I experimentation workshop - Mycotoxin model: functionalities and potential applications

HOLiFOOD organized on-line on the 18th June 2024 its 3° Living Labs Workshop on novel digital infrastructure for food safety, in collaboration with the EFRA project, offering:

- **Theory session**: overview of the HOLiFOOD research and development progress
- **Interactive parallel break-out session**: for co-creation through collaboration
- **Innovation and exchange of ideas** between experts

Aims

Explore the use of **AI and predictive analytics** to improve **food safety** standards and practices
Support the **HOLiFOOD platform** development by understanding **stakeholders needs**

Participants

Risk management, assessment and communication experts
food safety research institutions
Tech companies
Academia

I experimentation LL – Results

HOLiFOOD platform critical requirements

Enhanced **data integration**
More field data to improve AI prediction models.

Automation of data collection for real time model update
Risk mitigation for incorrect AI predictions

Stakeholder & Project Team

What can we achieve together?

Project team: Demonstrated the foreseen platform functionality and its reliability, accuracy, and privacy

Stakeholders: Their technical expertise actively contributed to the assessment and validation of the HOLiFOOD platform prototypes.

Together: Co-create effective strategies to enhance trust in AI and o digital technologies and encourage their broader acceptance and use in the food safety sector.

Join us for the next step!

AI for Food Safety: Harnessing the Power of Predictive Models through Digital Innovation

June 19th, 2025, hybrid event in collaboration with the EFRA project (https://efraproject.eu/).

This interactive session will explore how AI can enhance food safety by detecting and predicting contamination risks through two AI-driven case studies . You will have a chance to experiment with the innovative AI based tools and help us shape the future of predictive analytics for food safety.

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Towards integrated Food Safety Systems: AI-Driven early risk detection and holistic risk–benefit assessment frameworks

The HOLiFOOD White Paper

Methodology

- **Evidence-based approach** combining:
  project results and stakeholder validation in Living Labs

- **Iterative co-creation process:**
  exploration → experimentation → validation
  Stakeholder engagement in hands-on testing, feedback loops, refinement
  Focus on bridging technical outputs with real-world application

- **Cross-fertilization with external experts:**
  validation of relevance, feasibility, and positioning

- Co-development of **policy-relevant messages and recommendations**

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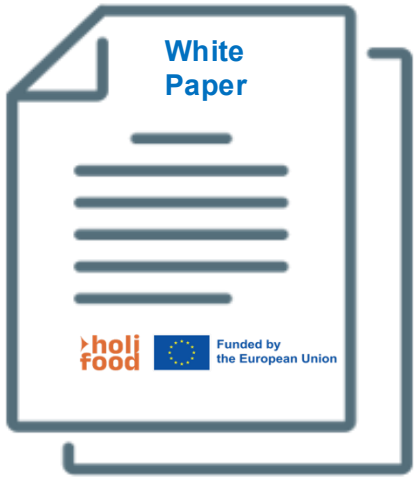
Structure



Two innovation areas:

AI-based tools for early risk detection

Holistic risk–benefit assessment frameworks

Four analytical components:

- **Understanding the context** → system drivers & complexity
- **Definition of the problem** → key challenges and operational barriers
- **Key findings** → project results validated by stakeholders
- **Outlook & recommendations** → positioning, uptake pathways & policy-relevant messages

Key Insights

AI-based early risk detection

- **Shift to anticipatory risk governance** → *from reactive to proactive, predictive approaches*
- **Data integration is the main driver of performances in AI-based risk assessment** → *key bottleneck and opportunity for improvement*
- **Not yet decision-ready** → *AI tools valuable for early warning, but not mature enough for high-stakes decisions*
- **Trust in AI depends on explainability** → *transparency is key for adoption*
- **Operationalisation challenges** → *existing workflow integration + tailoring to user's role are critical*
- **Adoption is systemic** → *infrastructure, skills, and co-creation are key enablers: organizational readiness + stakeholder engagement + human expertise*

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Key Insights

Holistic risk–benefit assessment framework

- **Need for a shift to systems thinking** → *from siloed risk assessment to integrated governance (food safety, nutrition, environment, economic, societal impacts)*
- **Trade-offs are central** → *decisions require balancing health, environment, economy (potentially competing outcomes, scientific vs societal priorities)*
- **Methodological ecosystem** → *combination of multiple complementary approaches: RBA, LCA, MCDA, economic analysis*
- **Fit-for-purpose implementation needed** → *tiered and context-specific approaches (adapting scope, method, level of detail to specific policy questions)*
- **Integration is the main challenge** → *across data, domains, and institutions. Lack of indicator to measure impact across key domains*
- **Beyond science** → *decision making combine evidence, uncertainty, and societal values*

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From findings to policy recommendations

Policy recommendations have been drafted based on HOLiFOOD results
Final prioritisation has been validated during the 3rd cross-fertilization workshop

- **Feasibility & readiness**: what can be realistically implemented in the short–medium term
- **Entry points for uptake**: where implementation should start: science / methodology; regulatory agencies; policy; processes industry
- **Conditions for implementation**: what needs to be in place: data access & interoperability; trust & transparency; skills & capacity; institutional support
- **Boundaries of applicability**: where these approaches are not yet suitable or mature
- **Priority for EU action**: recommendations to be prioritised at policy level

Thank you!

Questions?

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