



Funded by
the European Union

HOLiFOOD

**Future-Proofing Food: Transforming Risk Analysis
for a better and more adaptive food system**

HOLiFOOD

Title: Holistic approach for tackling food systems risks in a changing global environment

Coordinator: WFSR

Duration: 2022-2026

Partners: 17

Budget: €6 million

Website: www.holifoodproject.eu



HOLiFOOD – Strategic objectives

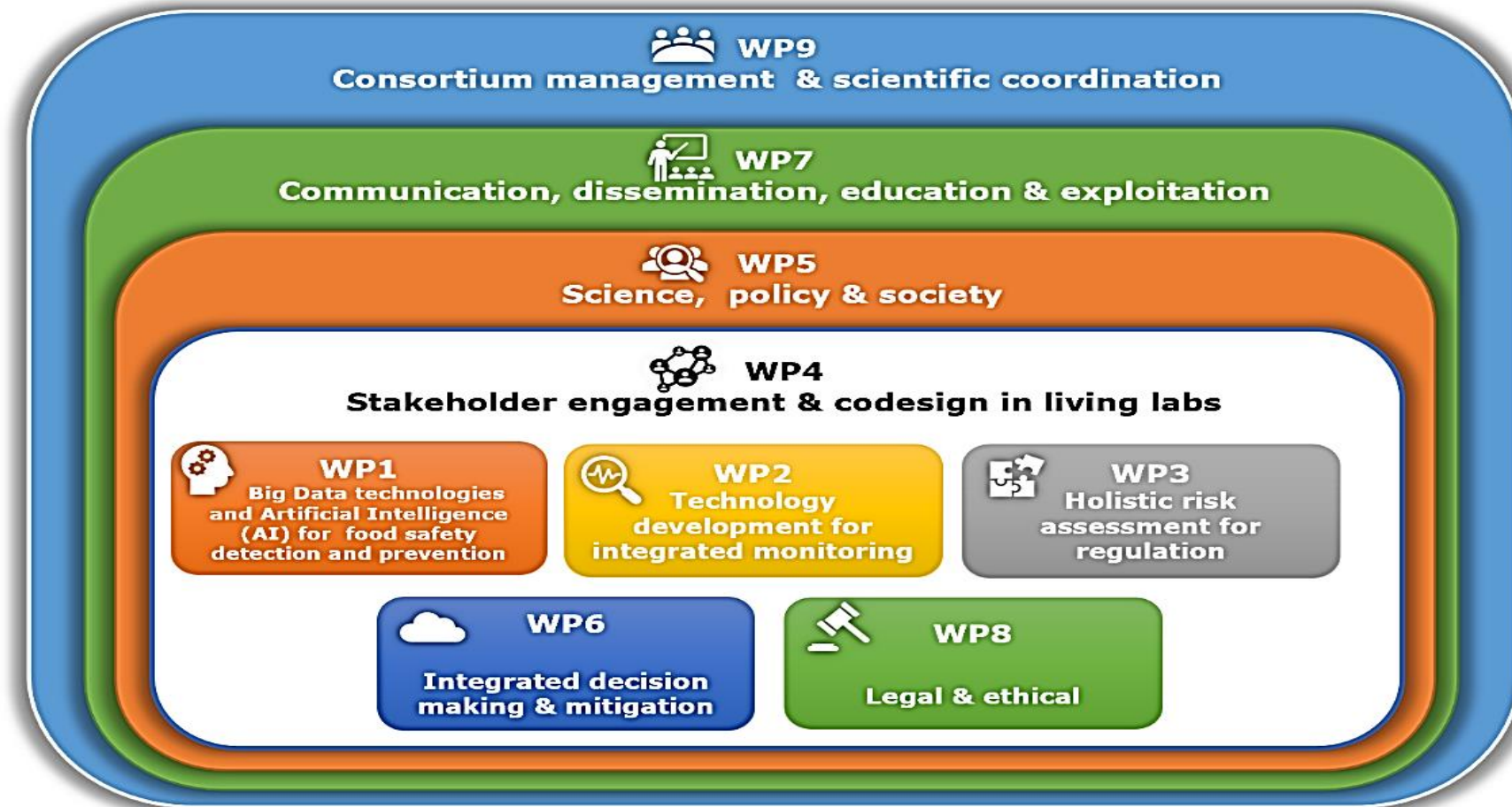
“To improve the integrated food safety risk analysis framework in Europe to:

- i) meet future challenges arising from Green Deal policy driven transitions in particular in relation to climate driven changes,*
- ii) contribute to the United Nations’ Sustainable Development Goals (SDG 2, 8, 9, 12, 15), and*
- iii) support the realization of a truly safe and sustainable food production” .*

Three selected supply chains:

- Poultry [broiler chicken]
- Cereals [maize]
- Legumes [lentils]

WP structure HOLiFOOD



HOLiFOOD – Specific objective 1

Early Warning and Emerging Risk Prediction:

Apply Big Data technologies and Artificial Intelligence (AI) for the development of methods and tools

To identify and monitor existing and emerging food safety risks (ERI) that will anticipate on the drivers of change due to a changing global environment

To support risk managers to take timely mitigating measures (WP1)

Cloud computing

AI & Big Data

AI & Big Data

AI & Big Data

Outcomes

Data collection, processing and visualisation from a number of actors throughout the food chain, using a system approach.



System approach



System approach



System approach

Food safety emerging risks system

Food security



Drivers of change



Science & Technology

Innovation
Digitalisation

Geo-politics

Globalisation
International trade

Socio-economics

Consumer preference
Income distribution

Demographics

Population growth
Urbanisation

Environment

Climate change
Natural resources

Socio-cultural

Social values
Food choices

Policy

Food security
Regulation

Cloud computing

AI & Big Data

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Outcomes

Data collection, processing and visualisation from a number of actors throughout the food chain, using a system approach.



System approach



System approach

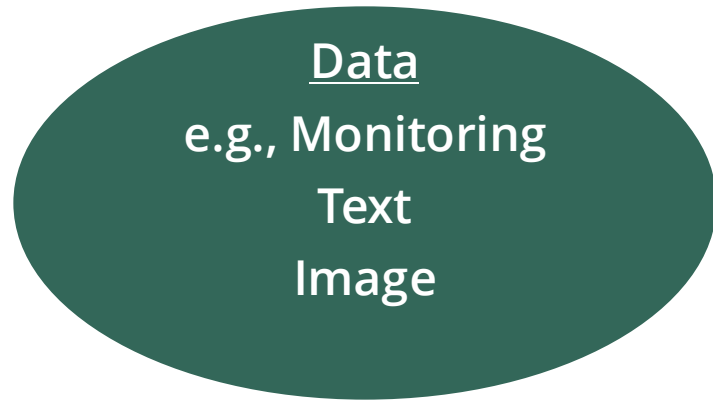


System approach

Food safety emerging risks system

Food security

What can AI and Big Data do?



What can AI and Big Data do?

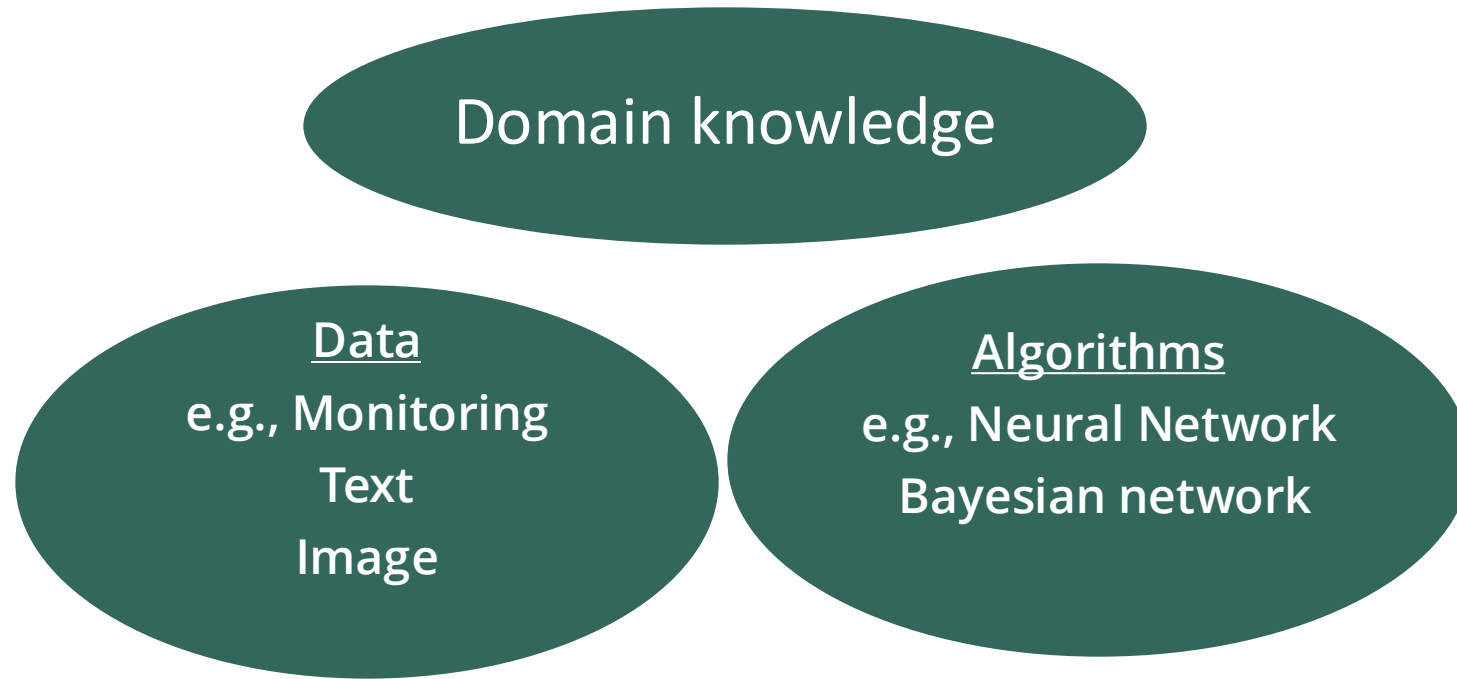
Data

e.g., Monitoring
Text
Image

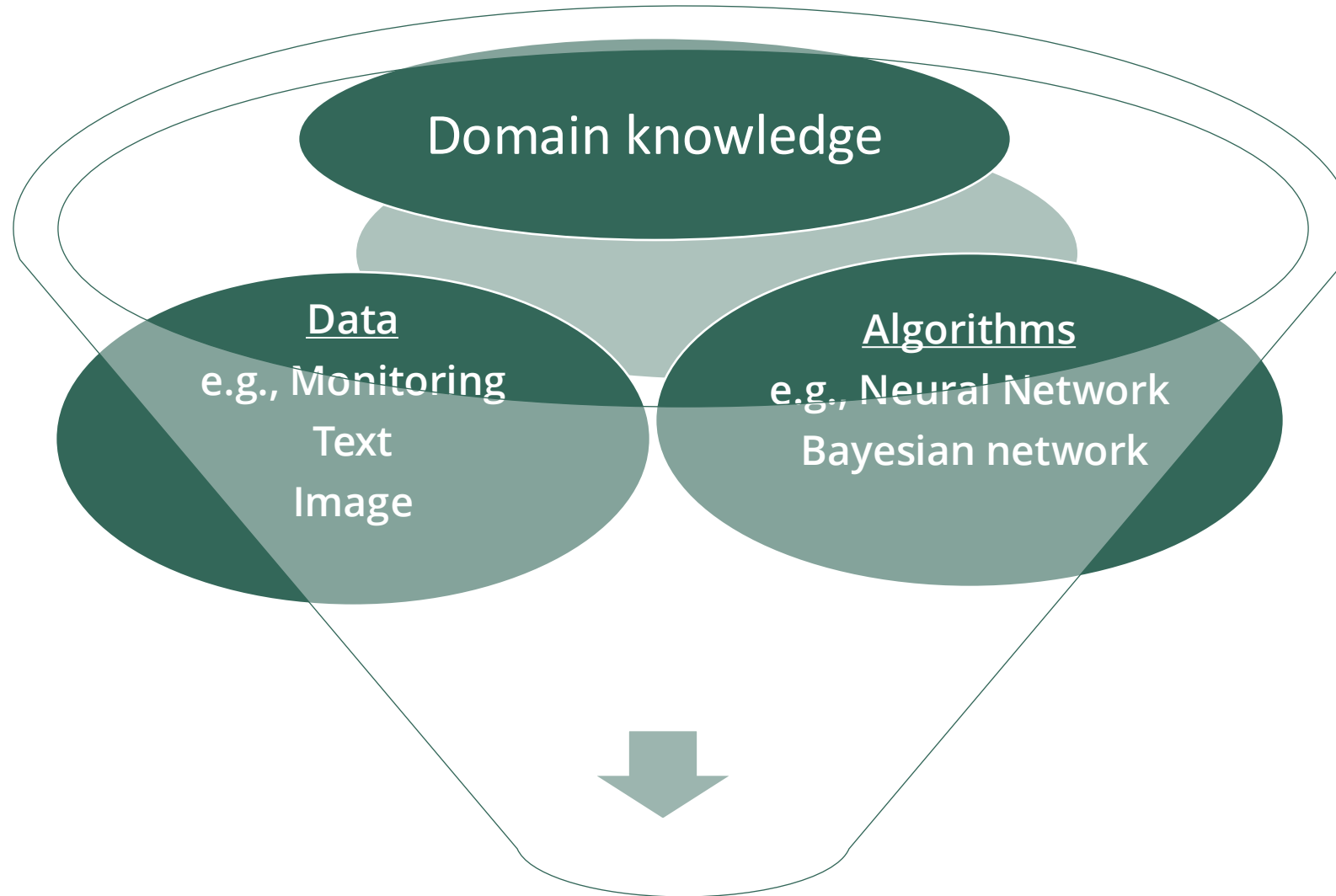
Algorithms

e.g., Neural Network
Bayesian network

What can AI and Big Data do?



What can AI and Big Data do?



Predict emerging food safety risks

Data sources



Structured data e.g., historical food safety monitoring data (EFSA), data on drivers of changes (e.g., FAOSTAT, World Bank, United Nations)



Unstructured data e.g., scientific literature (PMC), media news (EMM)

Prediction model for food safety contamination

Monitoring data



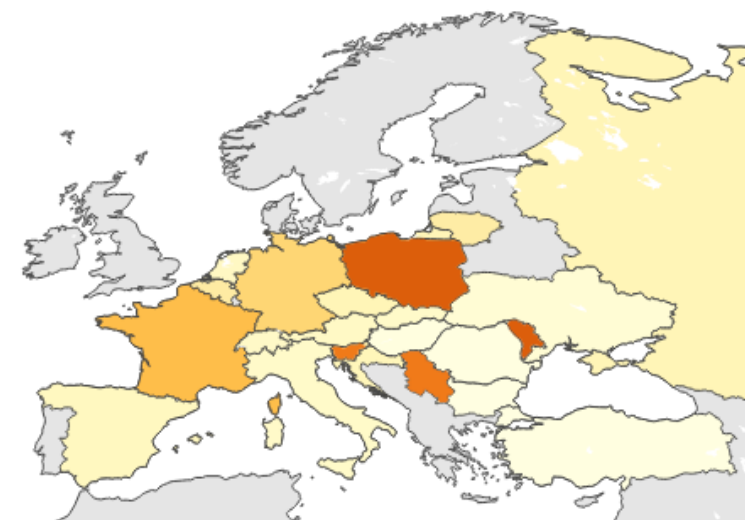
Drivers of change



Prediction model

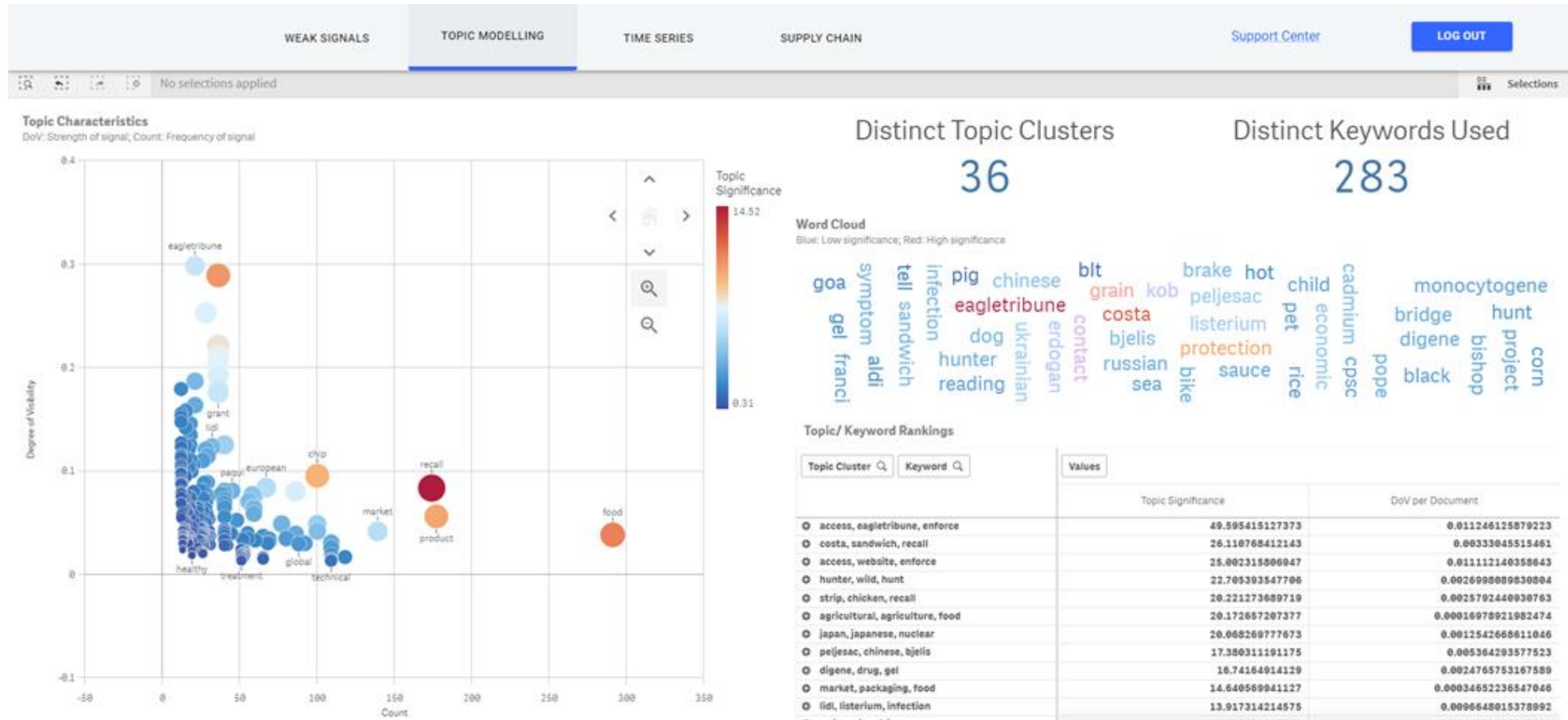


Food safety contamination



Topic modelling

- Identify and extract abstract topics from a collection of documents by analyzing the patterns of word co-occurrence within the texts

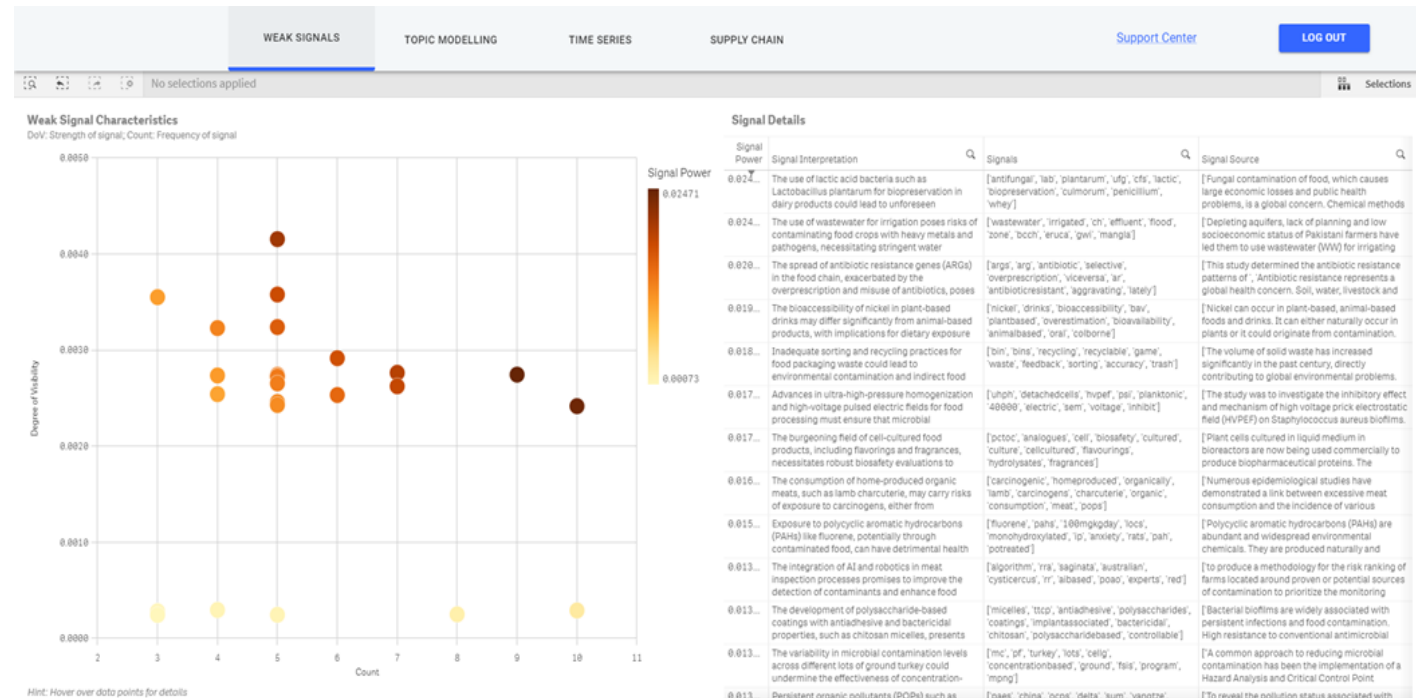
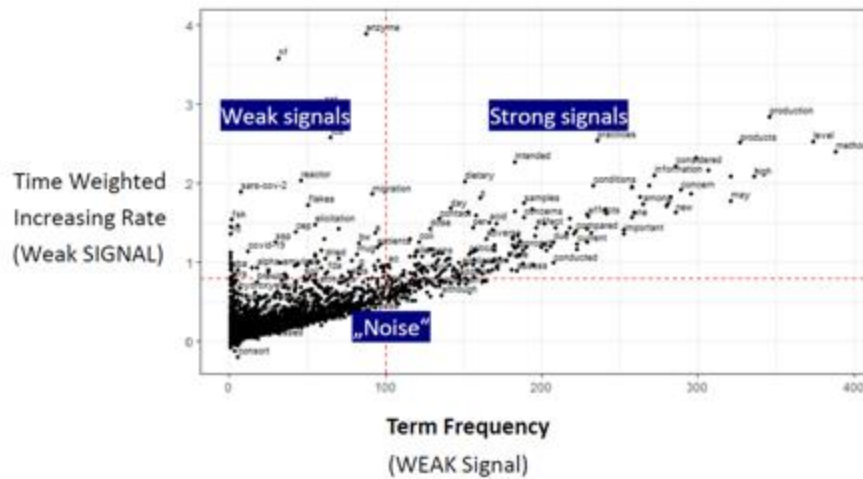


Weak signal miner

Weak signals focus on concepts that are infrequently mentioned yet exhibit significant changes over time

Unclear observable trends or patterns that warn us about the possibility of future events. They illustrate potential future developments (i.e. emerging issues) for which limited and scattered evidence is currently available

Keyword Emergence Matrix



Hint: Hover over data points for details

HOLiFOOD – Specific objective II

Targeted and non-targeted detection of existing and emerging hazards:

To develop and validate methods and devices for the identification and characterization of existing and (re-)emerging hazards

Chemical and biological [bacteria and viruses]

With the aim of anticipating and possibly mitigating/preventing impacts (preparedness)



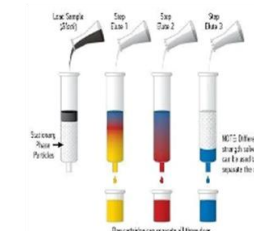
Untargeted methods for chemical Hazards: HRMS/AI



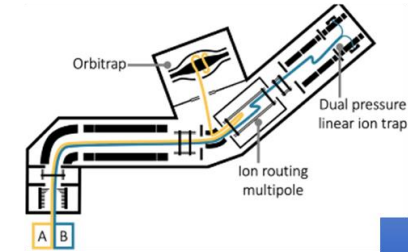
Antibiotics
Growth Promoters



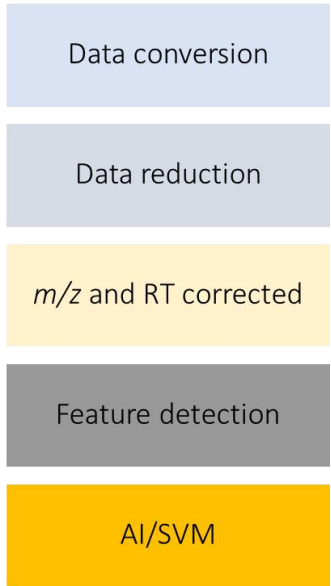
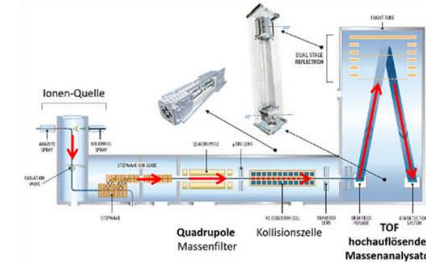
Mycotoxins
Plant toxins



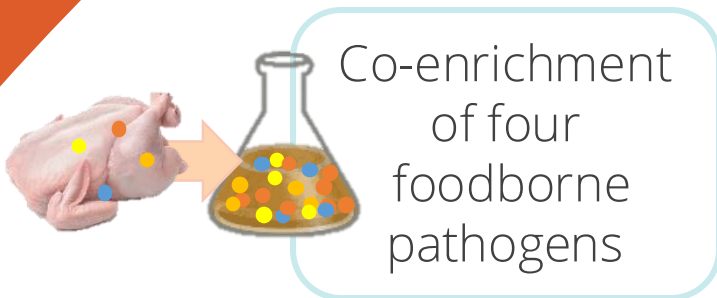
Generic
Sample Clean-up



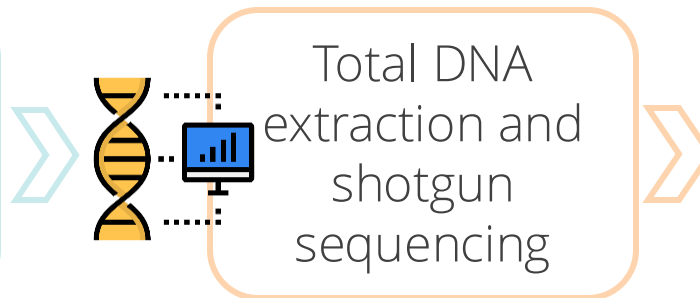
HRMS
(Full Scan, DDA, DIA)



Untargeted methods for biological hazards: quasimetagenomic approach

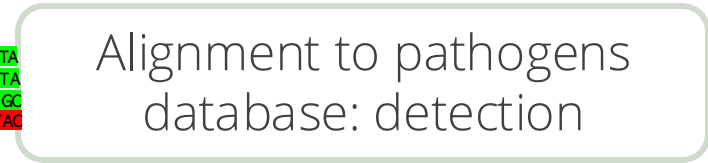


Co-enrichment
of four
foodborne
pathogens



Total DNA
extraction and
shotgun
sequencing

```
ATCAATGCATGGCTA
ATCAGTGCA CCAATA
GGCATA GGGCTACGG
GAGGTGGAAACGTAC
```

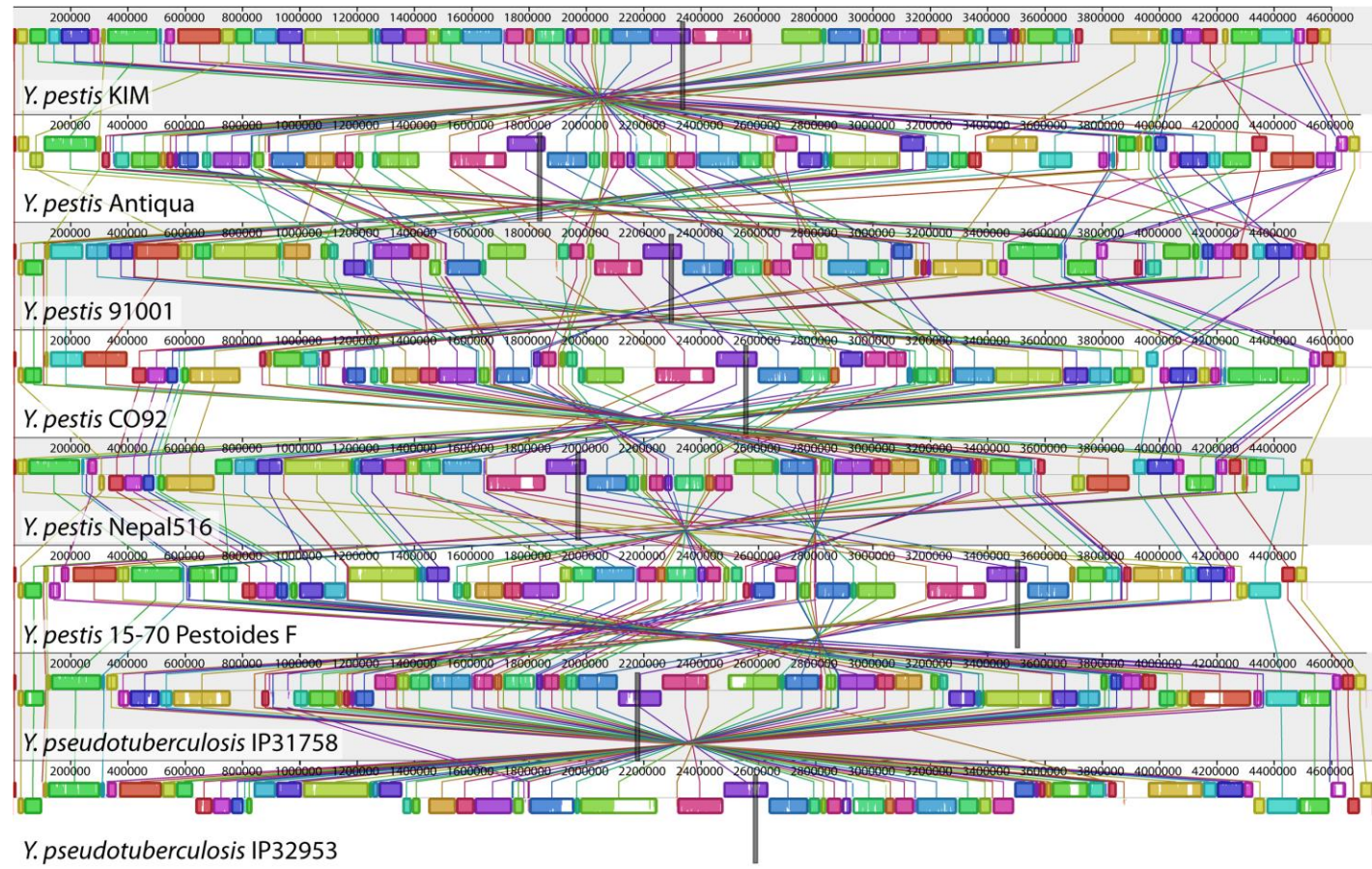


Alignment to pathogens
database: detection



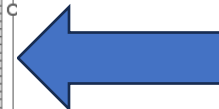
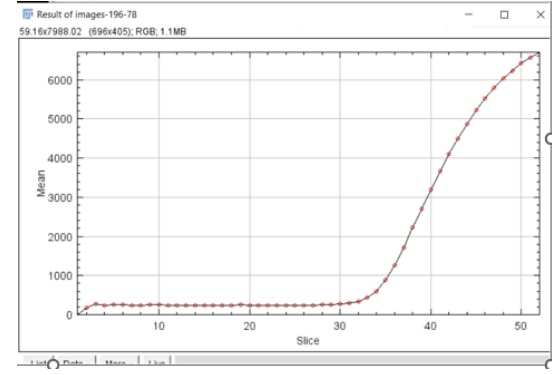
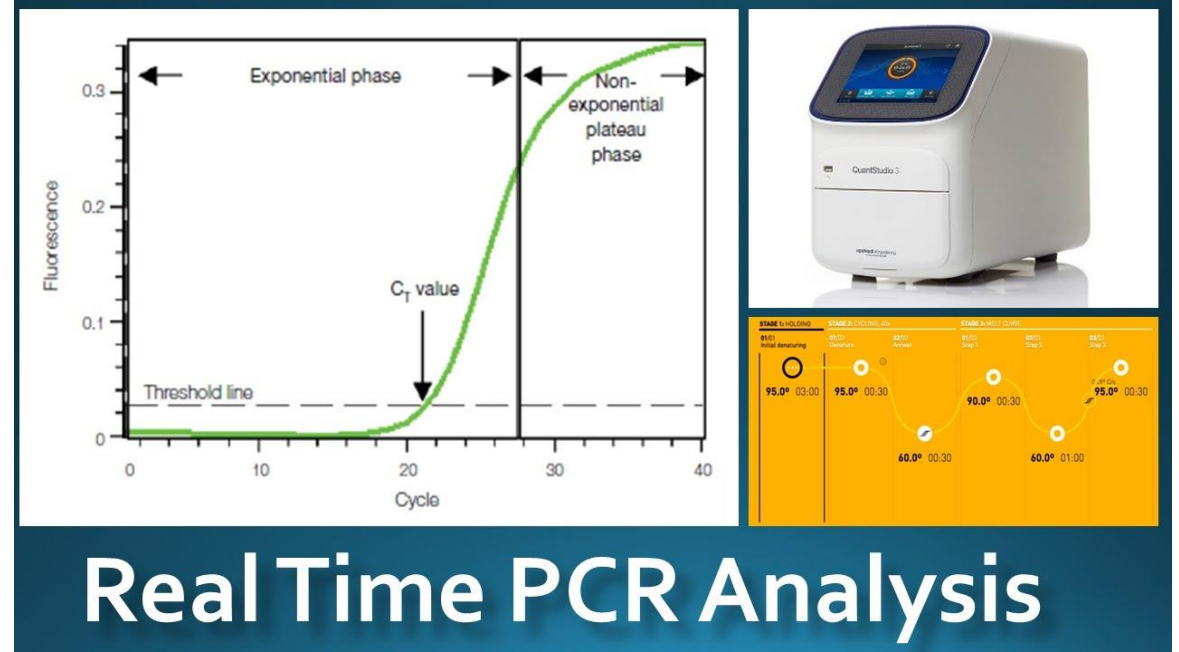
Typing, AMR, virulence,...

Comparative genomics and characterization of existing and re-emerging pathogens



Targeted methods for emerging and existing pathogens

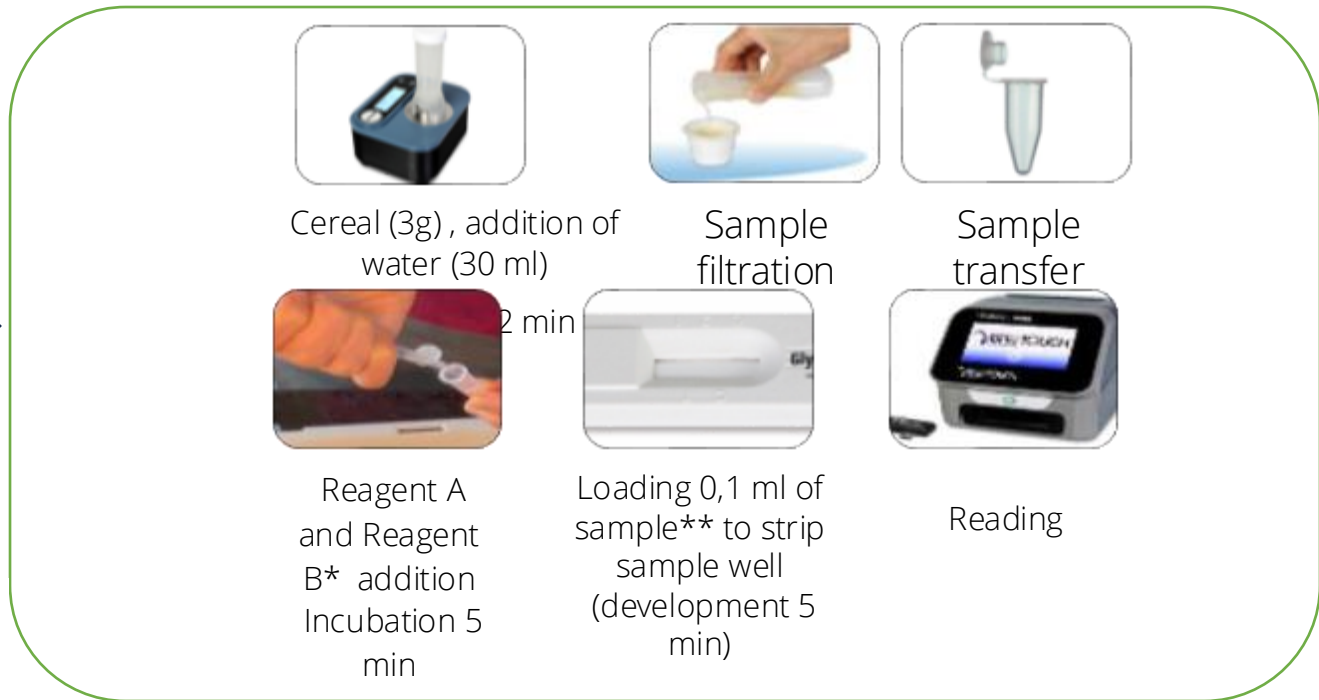
Real time PCR, digital PCR and Integrity PCR assays for the detection of emerging pathogenic bacteria and viruses



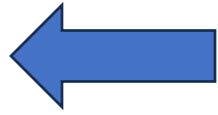
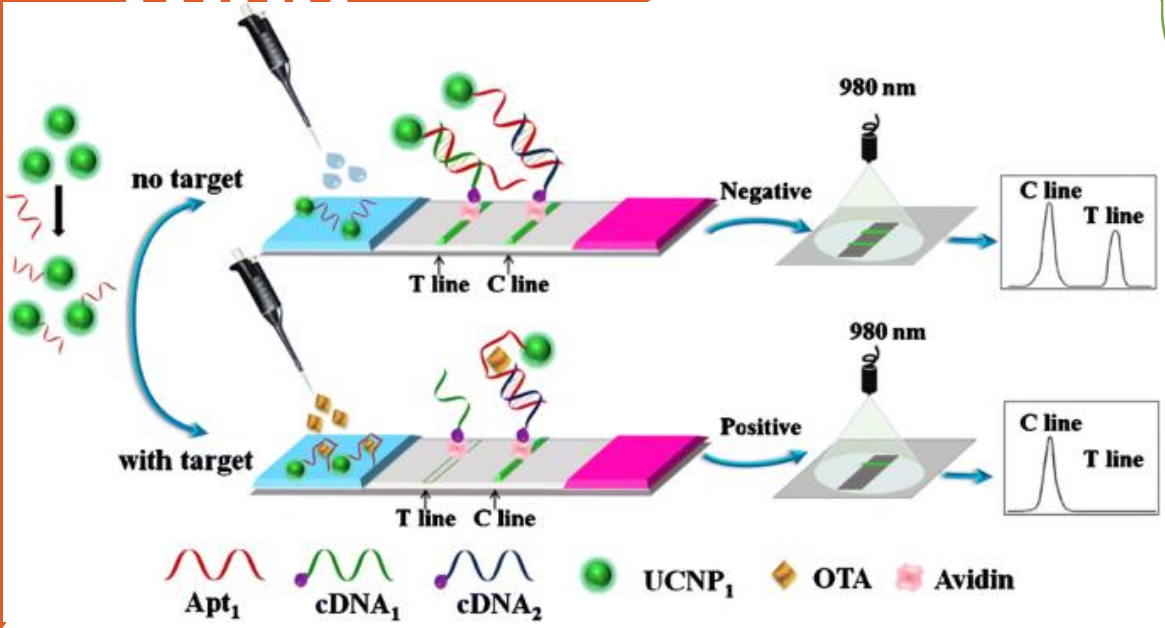
on-chip qPCR for on-site quantitative detection of emerging pathogenic bacteria in the targeted food supply chains

Targeted methods for chemical hazards

lateral flow devices for glyphosate (antibody based) in cereals and products of animal origin



holi food



aptamer based rapid tests (strip tests, ELISA) for aflatoxins/fumonisins in maize, tyramine/hystamine in poultry meat.

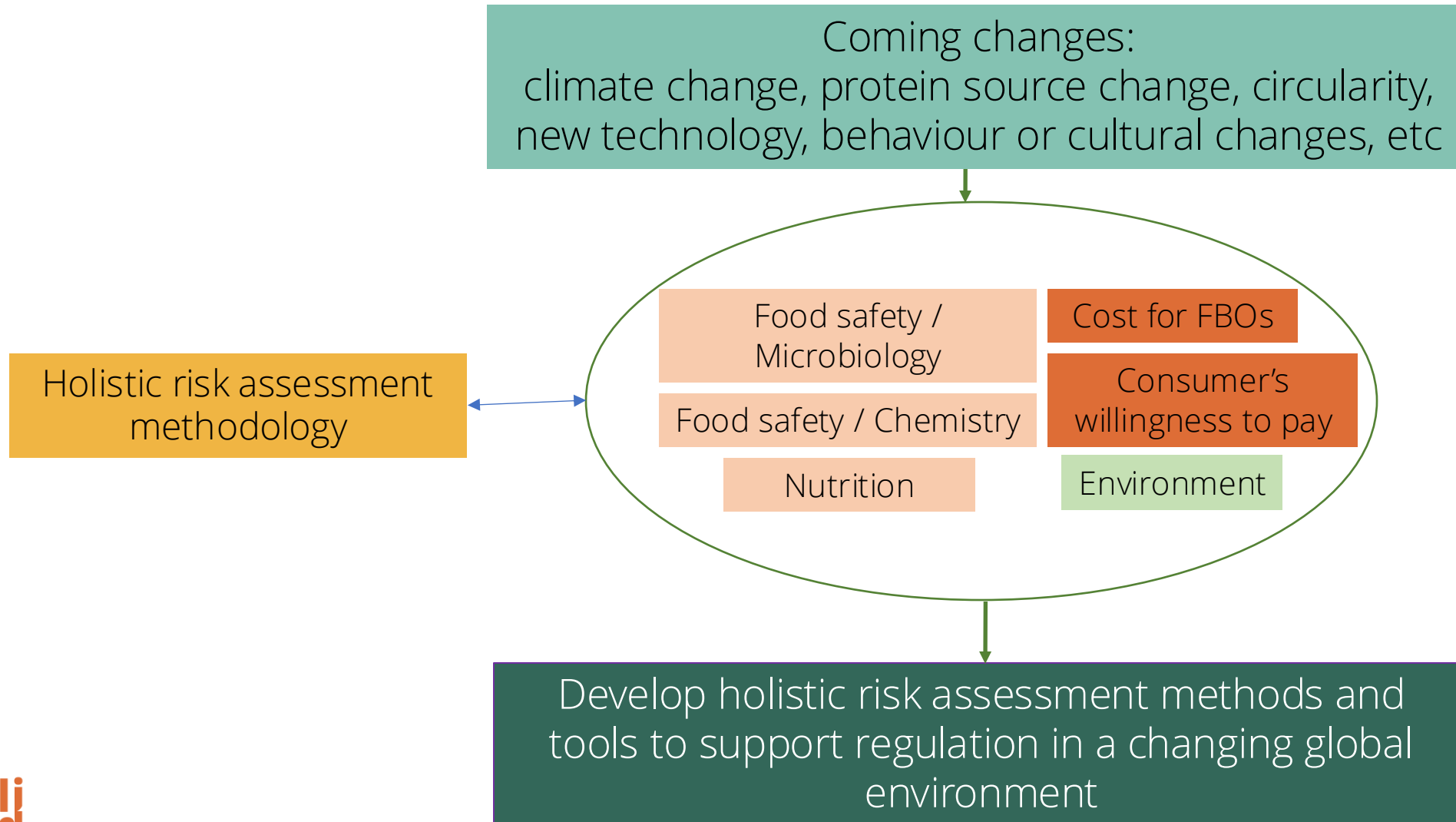
HOLiFOOD – Specific objective III

Holistic risk assessment for regulation:

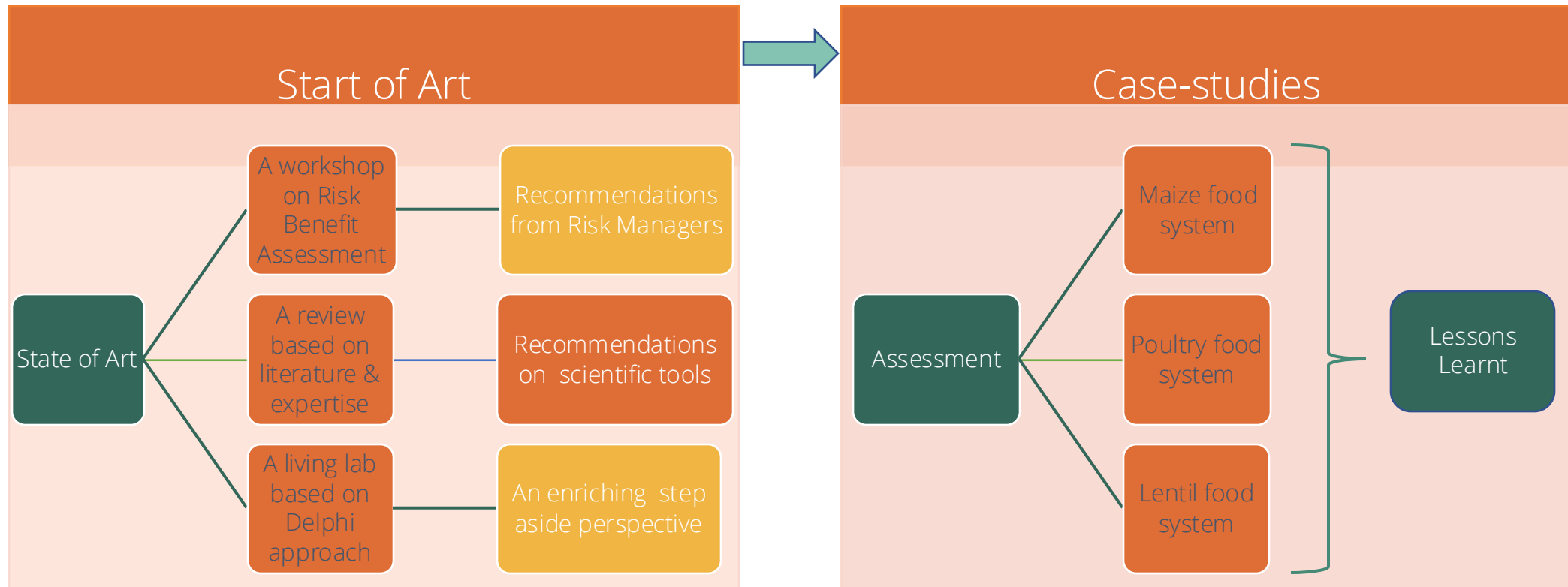
To develop holistic risk assessment methods and tools to support regulation in a changing global environment.

Food safety risk will be embedded in a comprehensive cost-benefit analysis of the food system including positive and negative health, environment and economic dimensions

Holistic assessment



Methodology



HOLiFOOD – Specific objective IV

Codesign and citizen science:

To ensure that all stakeholders benefit from improved food safety

Including consumers in vulnerable groups, small businesses and cooperatives within local supply chains

To integrate knowledge exchange through all activities

HOLiFOOD – Living labs

Three virtual HOLiFOOD Living Labs (LLs)



Aimed at addressing the following priorities:

1. Identification and monitoring of food safety risks,
2. Holistic risk assessment and acceptance
3. Platform co-design

Each LL has 4 co-creation events (one per year)

Bridge the gap between research and practice by facilitating discussions among the stakeholders, while systemically integrating the **Multi Actor Approach (MAA)** into all HOLiFOOD activities.



HOLiFOOD – Specific objective V

Data and knowledge sharing infrastructures:

To design and develop an Integrated European Data and Knowledge Exchange Infrastructure

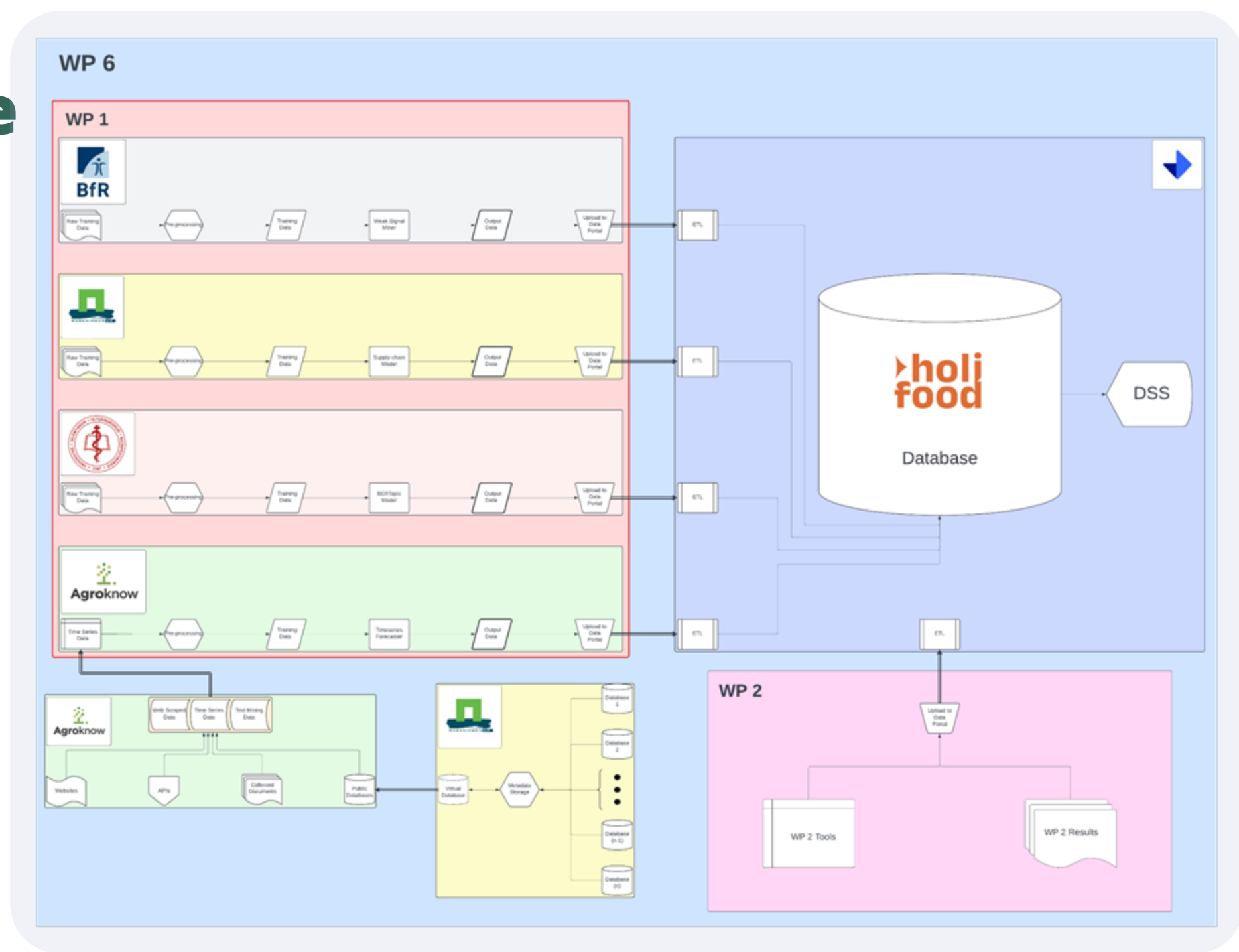
For decision support systems for the identification, assessment and mitigation of (emerging) food safety issues.

To integrate the HOLiFOOD infrastructure with software systems that already support food risk mitigation

Infrastructure Layout

The HOLiFOOD Infrastructure has been designed with respect to the needs and constraints of of the WP 1, WP 2 and WP 6 partners.

The infrastructure for WP 1 has been deployed, creating a full set of end-to-end dashboards.



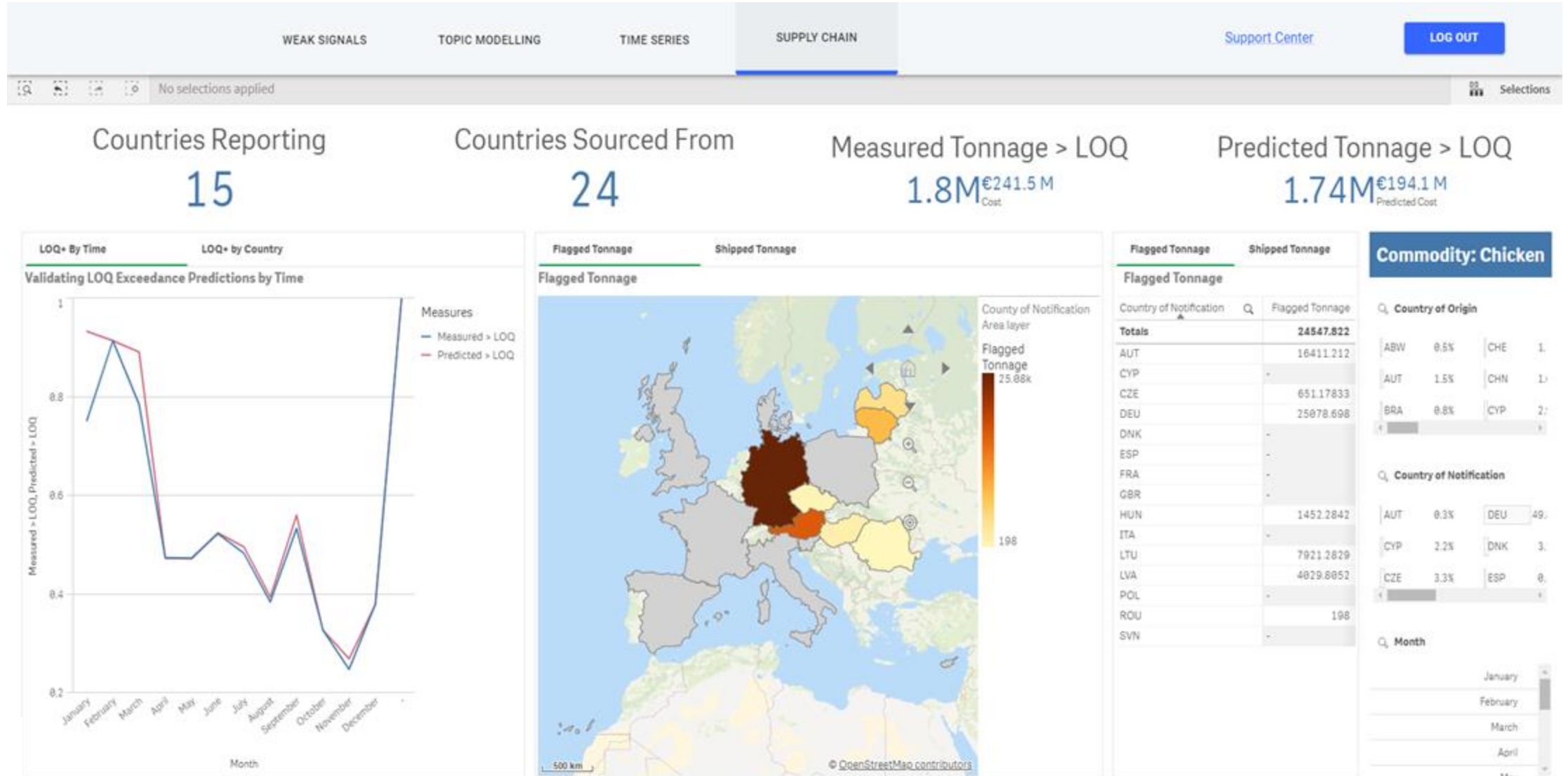
Data Visualisation

This dashboard displays the **topic modelling** used to cluster together related terms to find overlap between their prevalence.



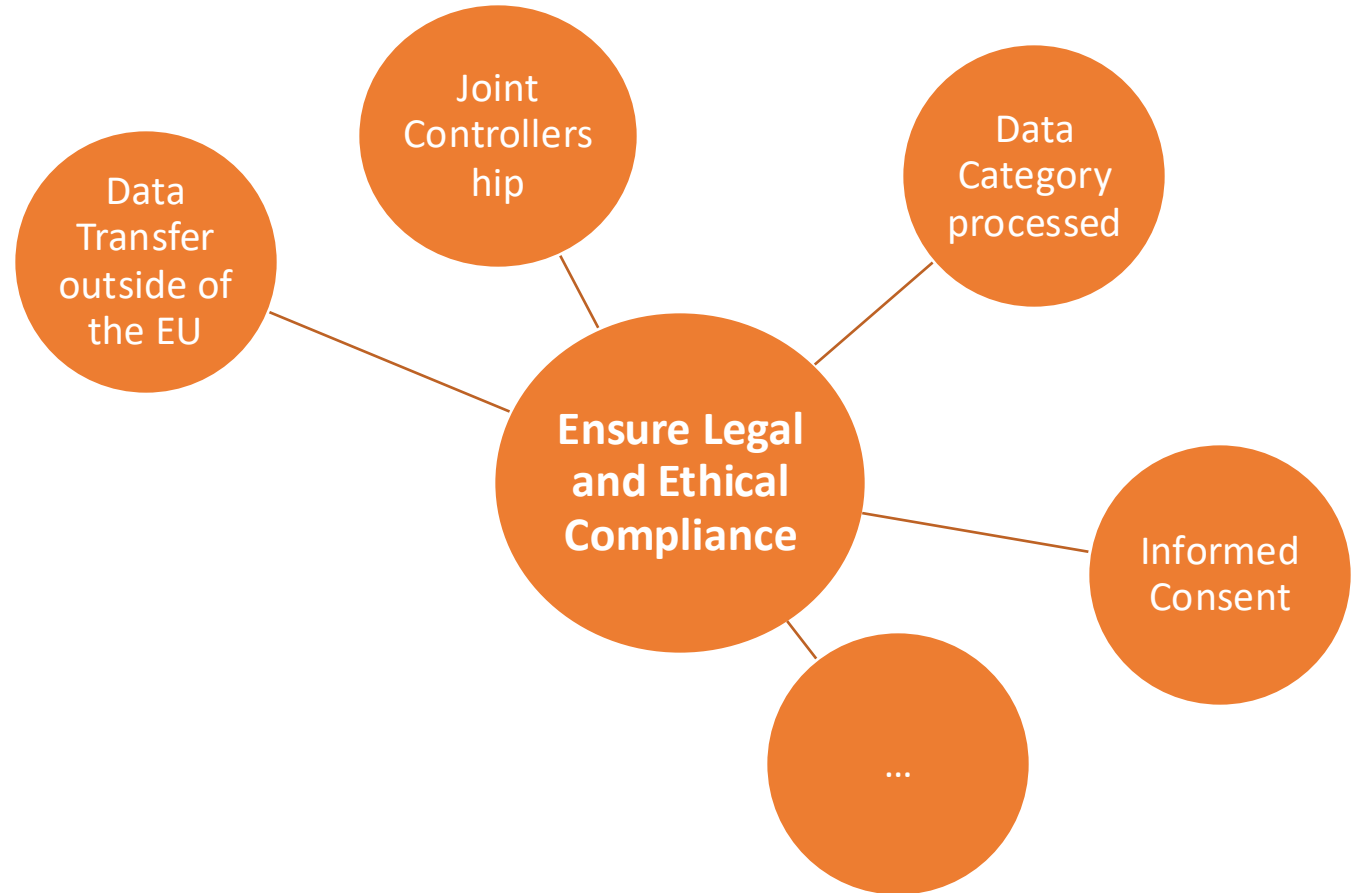
Data Visualisation

This dashboard looks at tracking and predicting pesticide exceedance across a number of commodities.



Legal and Ethical Framework

- ▶ Examining the existing ethical and legal frameworks applicable
- ▶ In particular in relation to the use of AI and big data analytics for a holistic risk assessment
 - ▶ E.g. GDPR, Data Act, Data Governance Act, AI Act ...
- ▶ Adoption of a human-rights focused approach to ensure the protection of the fundamental rights of individuals





Holistic approach for tackling food systems risks in a changing global environment

What is HOLiFOOD?

HOLiFOOD, which stands for 'Holistic approach for tackling food systems risks in a changing global environment', is a 4-year project funded by the European Commission under the Horizon Europe Programme. The project aims to improve the integrated **food**

The project's consortium is comprised of **17 organisations from 10 European countries**, whose multidisciplinary expertise and knowledge in the field will help deliver the methods and tools needed to support policymakers and food actors in taking effective