



Funded by
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HOLiFOOD Future- Proofing Food

Transforming Risk Analysis for a better and more adaptive food system

Nathan Meijer (WFSR)

09 October 2024, National Meeting of PEHO and the FSAI

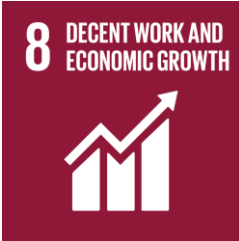
Project objectives

Title: **H**olistic approach for tackling **f**ood systems risks in a changing global environment

Coordinated by Prof Dr Ine van der Fels-Klerx, Wageningen Food Safety Research (WFSR), deputy coordinator Nathan Meijer (WFSR)

Aims: 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



Emerging risks

WHAT IS AN 'EMERGING FOOD RISK?'

A risk resulting from a newly identified hazard to which a significant exposure may occur, or from an **unexpected new or increased significant exposure** and/or susceptibility to a known hazard.



INCREASED EXPOSURE
TO KNOWN HAZARD



NEW
HAZARD



INCREASED SUSCEPTIBILITY
TO HAZARD

Example: mycotoxins

Factors contributing to mycotoxin production:



**INCREASED
TEMPERATURE
& HUMIDITY**



**EXTREME
WEATHER
EVENTS**



**ALTERED
PRECIPITATION
PATTERNS**

Mitigation strategies:



**CLIMATE-RESILIENT
AGRICULTURAL PRACTICES**



**ENHANCE STORAGE &
DRYING TECHNIQUES**



**DEVELOP EARLY
WARNING SYSTEMS**



**SUSTAINABLE
FARMING PRACTICES**

Supply chains of focus



Three selected supply chains:

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

‘Drivers of change’ may act as modifiers of effect on the onset of emerging risks

Project WP structure

WP9 Consortium management & scientific coordination

WP7 Communication, dissemination, education & exploitation

WP5 Science, policy & society

WP4 Stakeholder engagement & codesign in living labs

WP1 Big Data technologies and AI for food safety detection and prevention

WP2 Technology development for integrated monitoring

WP3 Holistic risk assessment for regulation

WP6 Integrated decision making & mitigation

WP8 Legal & ethical

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

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

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



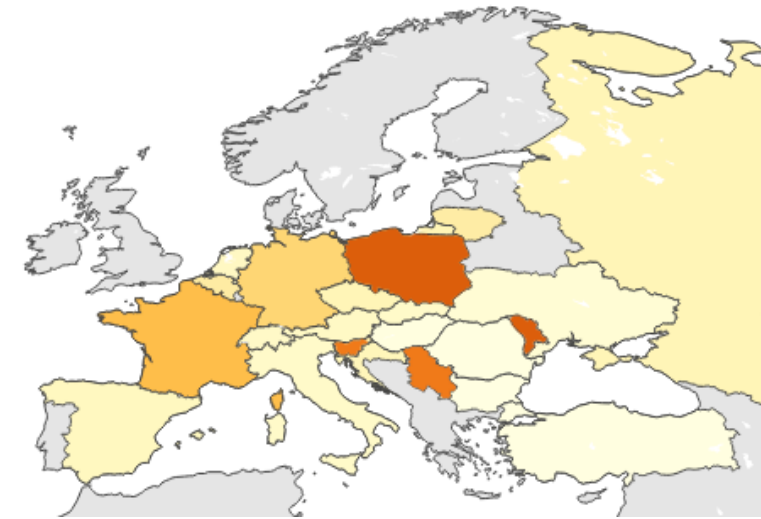
Drivers of change



Prediction model

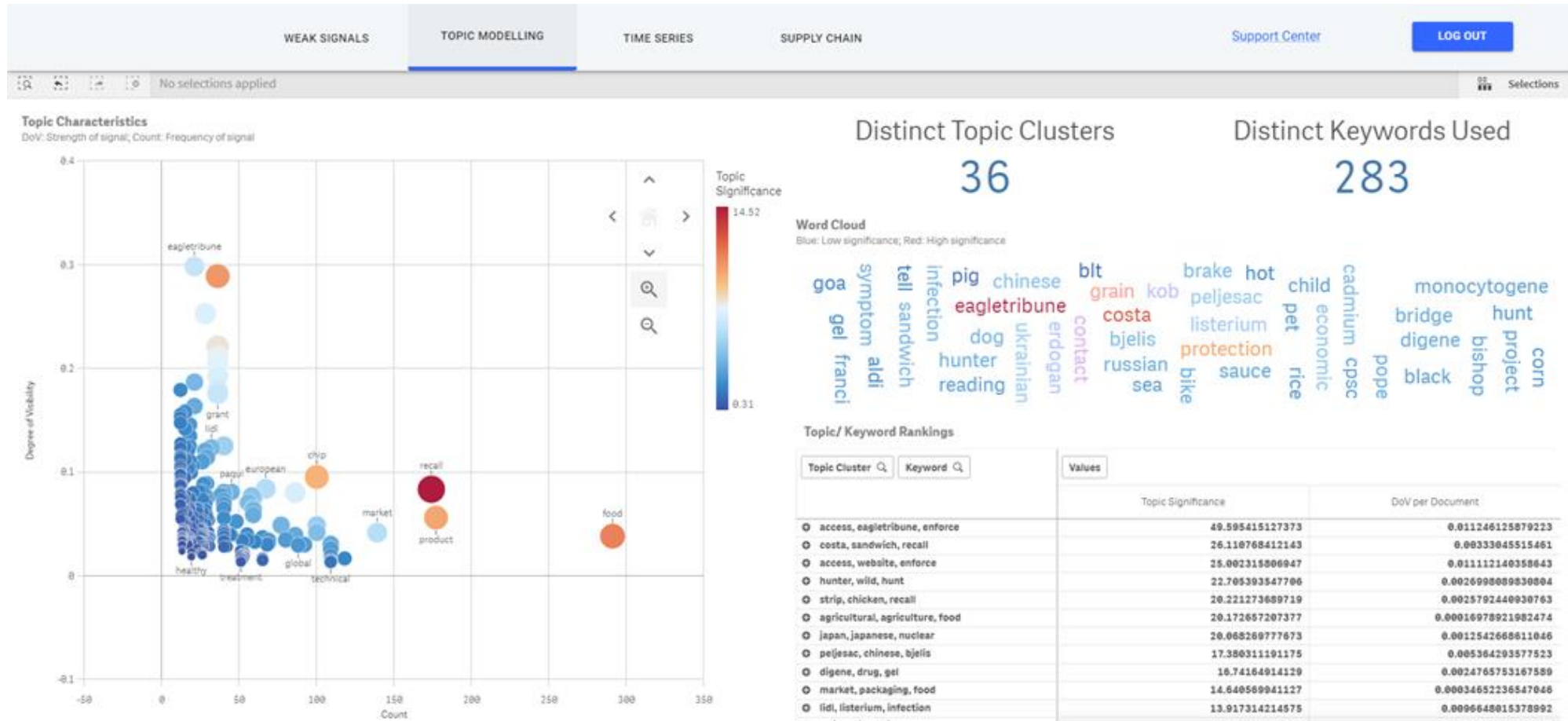


Food safety contamination



Topic modelling

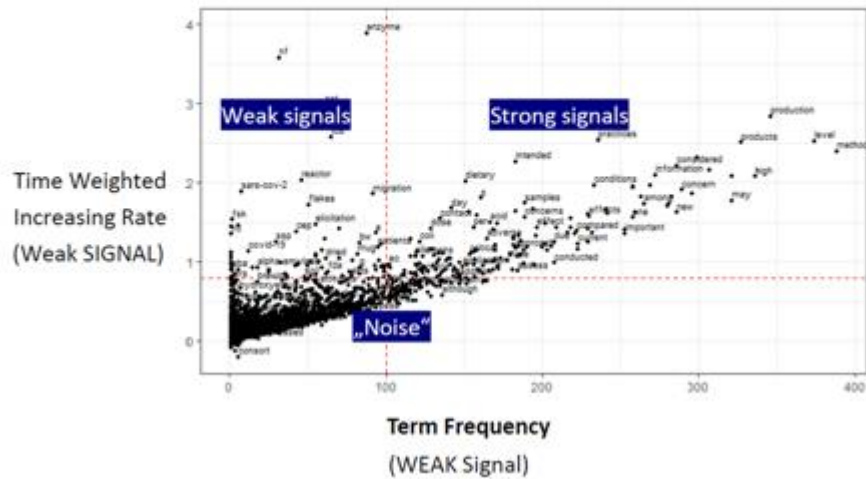
- Identify and extract abstract topics from a collection of documents by analyzing the patterns of word co-occurrence within the texts



Weak signal miner

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

Keyword Emergence Matrix



WEAK SIGNALS
TOPIC MODELLING
TIME SERIES
SUPPLY CHAIN
Support Center
LOG OUT

No selections applied
Selections

Weak Signal Characteristics

DoV: Strength of signal, Count: Frequency of signal

Hint: Hover over data points for details

Signal Details

Signal Power	Signal Interpretation	Signals	Signal Source
0.02471	The use of lactic acid bacteria such as Lactobacillus plantarum for biopreservation in dairy products could lead to unforeseen	[antifungal, 'lab', 'plantarum', 'ufg', 'cts', 'lactic', 'biopreservation', 'cultorum', 'penicillium', 'whey']	[Fungal contamination of food, which causes large economic losses and public health problems, is a global concern. Chemical methods
0.024	The use of wastewater for irrigation poses risks of contaminating food crops with heavy metals and pathogens, necessitating stringent water	[wastewater, 'irrigated', 'ch', 'effluent', 'flood', 'zone', 'bcch', 'aruca', 'pwl', 'manga']	[Depleting aquifers, lack of planning and low socioeconomic status of Pakistani farmers have led them to use wastewater (WW) for irrigating
0.020	The spread of antibiotic resistance genes (ARGs) in the food chain, exacerbated by the overprescription and misuse of antibiotics, poses	[args, 'arg', 'antibiotic', 'selective', 'overprescription', 'viceversa', 'ar', 'antibioticresistant', 'aggravating', 'lately']	[This study determined the antibiotic resistance patterns of, 'Antibiotic resistance represents a global health concern. Soil, water, livestock and
0.019	The bioaccessibility of nickel in plant-based drinks may differ significantly from animal-based products, with implications for dietary exposure	['nickel', 'drinks', 'bioaccessibility', 'bar', 'plantbased', 'overestimation', 'bioavailability', 'animalbased', 'brai', 'colborne']	[Nickel can occur in plant-based, animal-based foods and drinks. It can either naturally occur in plants or it could originate from contamination.
0.018	Inadequate sorting and recycling practices for food packaging waste could lead to environmental contamination and indirect food	['bin', 'bins', 'recycling', 'recyclable', 'game', 'waste', 'feedback', 'sorting', 'accuracy', 'trash']	[The volume of solid waste has increased significantly in the past century, directly contributing to global environmental problems.
0.017	Advances in ultra-high-pressure homogenization and high-voltage pulsed electric fields for food processing must ensure that microbial	[uhph, 'detachedcells', 'hupel', 'pai', 'planctonic', '40000', 'electric', 'sem', 'voltage', 'inhibic']	[The study was to investigate the inhibitory effect and mechanism of high voltage pulsed electrostatic field (HVPEF) on Staphylococcus aureus biofilms.
0.017	The burgeoning field of cell-cultured food products, including flavorings and fragrances, necessitates robust biosafety evaluations to	['pctoc', 'analogues', 'cell', 'biosafety', 'cultured', 'culture', 'cellcultured', 'flavourings', 'hydrolysates', 'fragrances']	[Plant cells cultured in liquid medium in bioreactors are now being used commercially to produce biopharmaceutical proteins. The
0.016	The consumption of home-produced organic meats, such as lamb charcuterie, may carry risks of exposure to carcinogens, either from	[carcinogenic, 'homeproduced', 'organically', 'lamb', 'carcinogens', 'charcuterie', 'organic', 'consumption', 'meat', 'pops']	[Numerous epidemiological studies have demonstrated a link between excessive meat consumption and the incidence of various
0.015	Exposure to polycyclic aromatic hydrocarbons (PAHs) like fluorene, potentially through contaminated food, can have detrimental health	[fluorene, 'pahs', '100mgkgdwy', 'locs', 'monohydroxylated', 'ip', 'aromatic', 'rats', 'pah', 'potreated']	[Polycyclic aromatic hydrocarbons (PAHs) are abundant and widespread environmental chemicals. They are produced naturally and
0.013	The integration of AI and robotics in meat inspection processes promises to improve the detection of contaminants and enhance food	[algorithm, 'ira', 'saginata', 'australian', 'cysticercus', 'rr', 'albased', 'paso', 'experts', 'red']	[To produce a methodology for the risk ranking of farms located around proven or potential sources of contamination to prioritize the monitoring
0.013	The development of polysaccharide-based coatings with antiadhesive and bactericidal properties, such as chitosan micelles, presents	['micelles', 'ttop', 'antiadhesive', 'polysaccharides', 'coatings', 'implantassociated', 'bactericidal', 'chitosan', 'polysaccharidebased', 'controllable']	[Bacterial biofilms are widely associated with persistent infections and food contamination. High resistance to conventional antimicrobial
0.013	The variability in microbial contamination levels across different lots of ground turkey could undermine the effectiveness of concentration-	['mc', 'of', 'turkey', 'lots', 'cellig', 'concentrationbased', 'ground', 'tss', 'program', 'mpng']	[A common approach to reducing microbial contamination has been the implementation of a Hazard Analysis and Critical Control Point
0.013	Persistent organic pollutants (POPs) such as	[toaes, 'china', 'occs', 'delta', 'sum', 'vanotze']	[To reveal the pollution status associated with

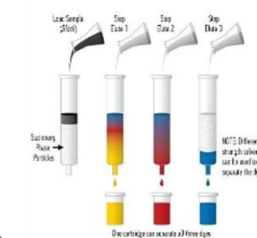
Untargeted methods for chemical Hazards: HRMS/AI



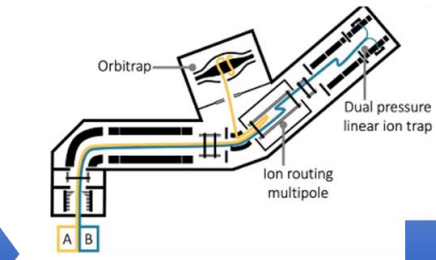
Antibiotics
Growth Promoters



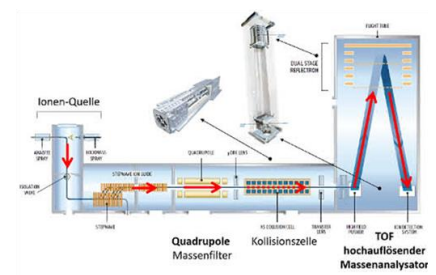
Mycotoxins
Plant toxins



Generic
Sample Clean-up

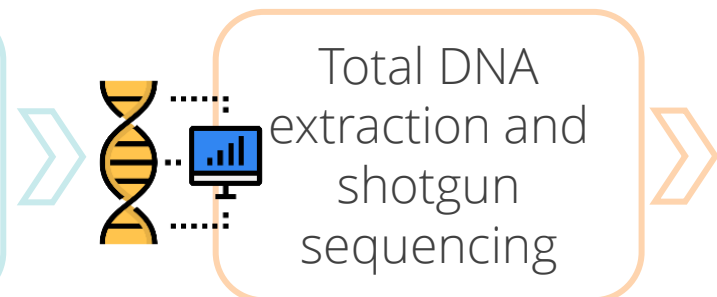
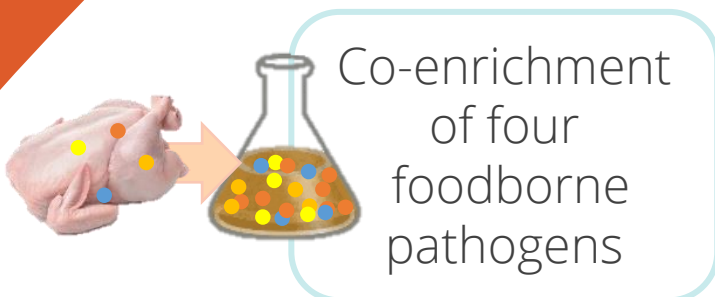


HRMS
(Full Scan, DDA, DIA)



- Data conversion
- Data reduction
- m/z and RT corrected
- Feature detection
- AI/SVM

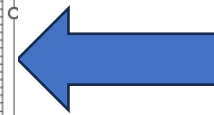
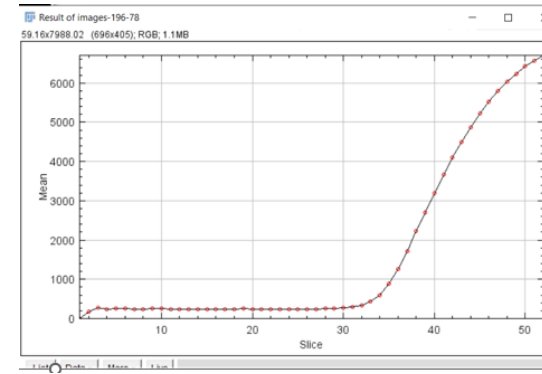
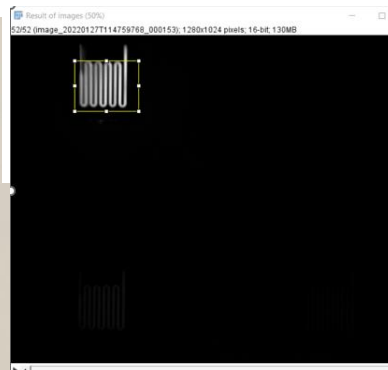
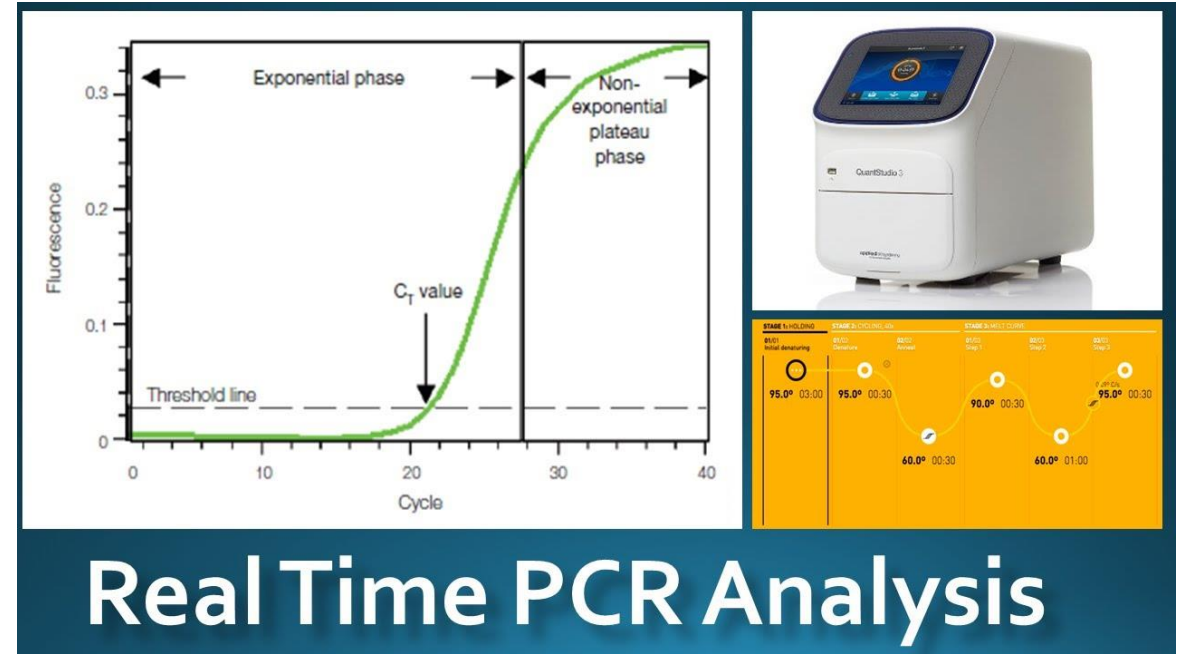
Untargeted methods for biological hazards: quasimetagenomic approach



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ATCAATGCATGGCTA
ATCA GTGCA CCAATA
GGCATAGGGCTACGG
GAGGTGCAAACGTAC
```

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

Living labs: iterative co-design

- ▶ WP4: facilitate LL managers organizing
 - ▶ Interact with specific other WPs to co-design outputs
- ▶ **WP1:** Methods and data sources for emerging risk identification: Verification and prioritization
- ▶ **WP3:** Inductive research using Delphi as both scoping and data gathering exercise
- ▶ **WP6:** Novel Digital Infrastructure for Food Safety

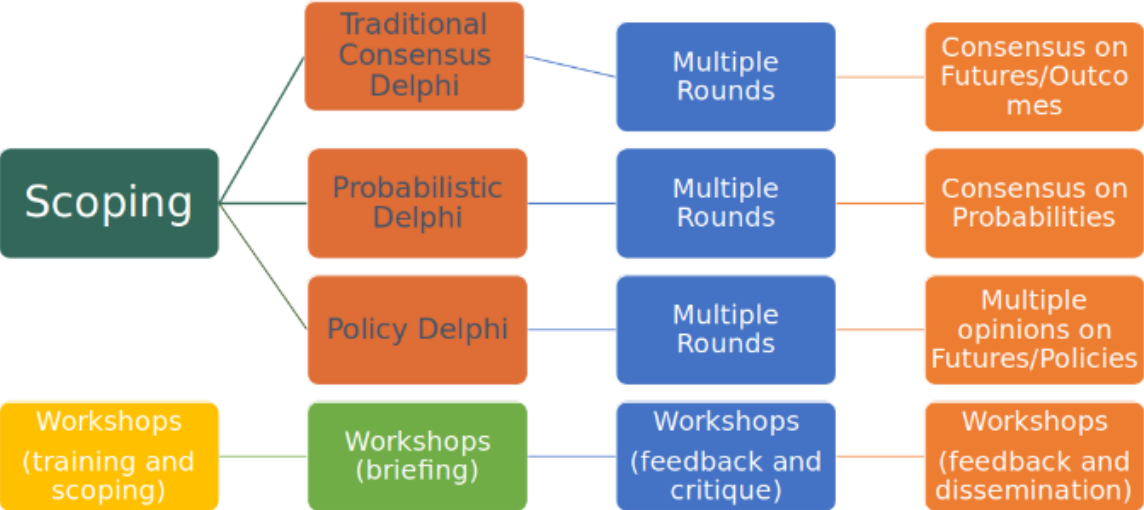
Definition:

A user-driven open innovation ecosystem based on a business-citizens-government partnership which enables users to take active part in the research, development and innovation process

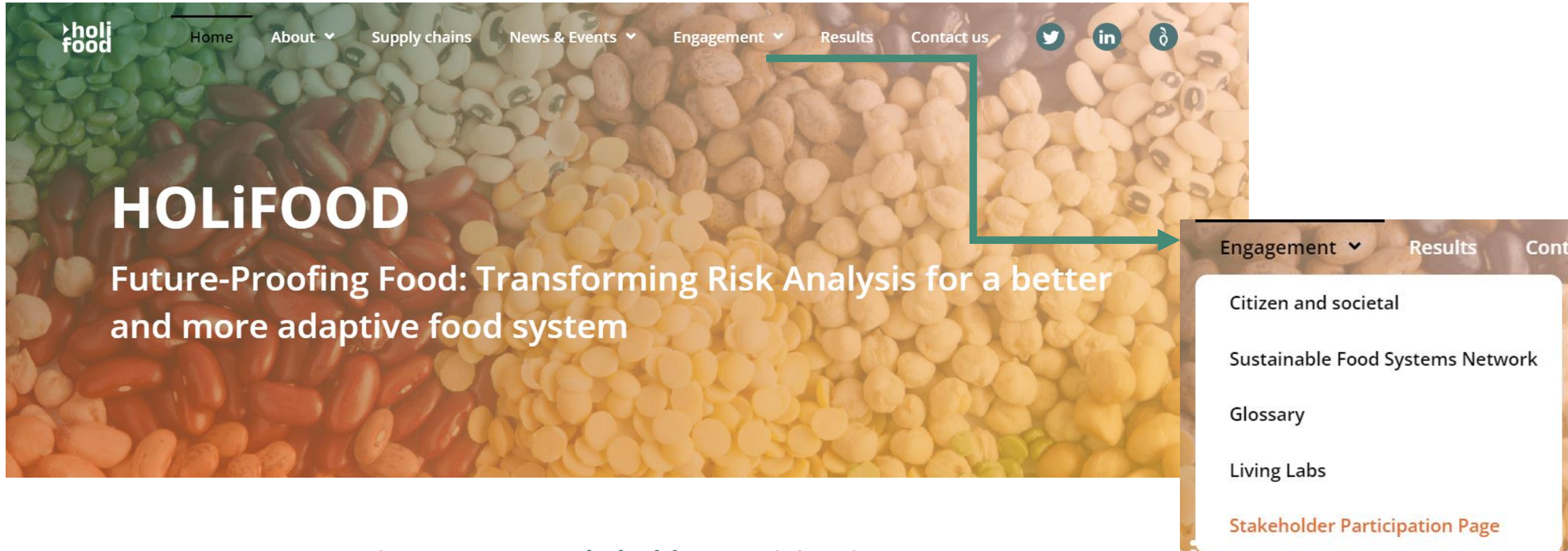
THE EXPERIENCE OF THE FIRST LIVING LAB

Holifood LL #2: the Delphi Method

Phases



WOULD YOU LIKE TO PARTICIPATE IN UPCOMING LIVING LABS?



The image shows a screenshot of the HoliFood website. The background is a close-up of various beans in shades of green, red, and yellow. The website header includes the HoliFood logo and a navigation menu with the following items: Home, About, Supply chains, News & Events, Engagement, Results, and Contact us. There are also social media icons for Twitter, LinkedIn, and YouTube. The main content area features the text: "HOLiFOOD Future-Proofing Food: Transforming Risk Analysis for a better and more adaptive food system". A green arrow points from the 'Engagement' menu item to a dropdown menu that is open, showing the following options: Citizen and societal, Sustainable Food Systems Network, Glossary, Living Labs, and Stakeholder Participation Page. The 'Stakeholder Participation Page' is highlighted in orange.

Register on our stakeholder participation page on
the official HoliFood website!
holifoodproject.eu/

Thank you!

Questions?



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