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FOR FOOD SAFETY IN EUROPE

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Strategic Research and Innovation Agenda for Food Safety in Europe

FS4EU input for fast-response SRIA on priority challenges in emerging/novel food hazards and risks

CONTRIBUTORS & OWNERS

IBA - National Research and Development Institute for Food Bioresources

Contact: Prof. Nastasia Belc
e-mail: nastasia.belc@bioresurse.ro

Technical University of Munich
CNR ISPA National Research Council of Italy

This document aims at presenting the results of the **participatory process** carried out by the **FoodSafety4EU** project, a Coordination and Support Action funded by the EU's Research and Innovation Horizon 2020 programme.

A multi-stakeholder group of selected experts has co- designed the contents, discussed and defined the main topics to be addressed by a new **Strategic Research and Innovation Agenda (SRIA)**, that matches the future challenges of the European Food Safety System.

The iterative process has been conducted by a project team led by IBA Bucharest, partner of the FS4EU project, involving more than 30 experts in the discussion and confrontation, supported by professionals in social innovation, who have facilitated the implementation of the methodology. The final SRIA is presented to EU Commission, EFSA, JRC representatives, Universities, Research Centers, Industries, Producers and Consumers associations at the first **European Food Safety Forum** on 28 and 29 November 2023 in Brussels.

This document is a summary of the SRIA, reporting and presenting:

- SRIA description, the main challenges identified by the experts and the co-creation methodology
- per each identified challenge:
  - selected topics
  - expected action plan/measures to be taken in medium or short term perspective for ensuring the transition towards a more comprehensive Food Safety System in Europe
  - expected outcomes
  - matrix on topics emergency vs uncertainty, representing the prioritization of the defined topics
- areas of intervention, as main impact areas addressed by the SRIA.

The full document is available on the [platform website](.).

Authors: Nastasia Belc, Denisa Duta, Michael Rychlik, Nunzia Cito, and Veronica Lattanzio.

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PRESENTATION

The **Strategic Research and Innovation Agenda** (**SRIA**) **on Food Safety emerging/novel food hazards and risks** outlines the framework for future research, development, and innovation to achieve the EU's food safety policy goals: to ensure safe, nutritious food, high animal health and welfare standards, plant protection, and clear product information.

The new SRIA aims at addressing the **future research needs** to ensure a **SAFE transition** towards sustainable food systems under the edge of the new sustainability regulation.
It provides input to assess/ensure the safety of food innovations, by proposing tools, methodologies, knowledge to address food safety hazards and risks (re)-emerging in circular, bio-based, sustainable food systems of the future.

The SRIA is the result of a participative process, led by the FS4EU Horizon 2020 project, based on the active participation of a **multi-stakeholder group**, who has considered needs and provided input to develop a strategy for a shared and more coherent **agenda.** The FS4EU partners and involved experts have co-designed a proposal for a SRIA focusing on "Food Safety emerging/Novel food hazards and risks", by identifying **8 challenges** (listed below) and formulating relevant hazard and actions, resulting in **112** Research & Innovation (R&I) topics. They have then prioritized these topics according to a short-medium-long term perspective on the basis of their emergency and uncertainty. Finally, the multi-disciplinary group has defined cross- links among these topics, useful to explore any relation in terms of mutual influence and synergic impact. The prioritization led to the definition of **21** topics in total, feeding **short-term action plans** to be undertaken by researchers and innovators in the near future, as well as to be considered in funding programmes and research plans, and other agendas.

Challenges addressed by the SRIA for the Food Safety in EUROPE

1. Climate change and food security
2. Food Supply Chain: Traceability & Transparency
3. Integration & Improving Risk Assessment Methodologies
4. Rapid Technological Advancement & Emerging Technologies
5. Sustainable Production/Processing
6. Ethics and One Health Systemic Approach
7. Science-based Decision Making
8. Food Safety Related Issues and Sharing Information & Resources

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CO-CREATION METHODOLOGY

The **co-creation of the Strategic Research and Innovation Agenda (SRIA)** is a participatory process based on the social-living laboratory (lab) methodology. These labs are rooms for discussion, co-creation, experimentation, cross learning and fertilization, where multi-actor groups co-design input for the EU Food Safety System.

The methodology includes **6** steps of collaborative work carried out by experts invited to the lab, and coordinated by a Lab manager. Starting from the existing strategic documents and addressing the needs of diverse stakeholders, the methodology allows to identify and prioritize challenges, to validate the selection made by the experts through an extensive consultation, to co-create shared topics as input for the SRIA with short-medium-long term action plans.

MAIN STEPS

1
Setting the multi-actor expert group
A multi-actor group of experts from different backgrounds: Research& Academia, Food Safety Authorities and risk assessors, Food Business Operators, EU policy makers, Consumers associations, Experts participating in relevant European platforms jointly develop an idea to co-create the SRIA.

2
Topic diagnosis
Starting from the analysis of the existing Research Agendas related to Food Safety issues, the group identifies and cluster the **key challenges** in food safety domain and associated **R&D directions** to manage/minimize their effects.

3
Clustering of R&I directions in core themes and rating
The group clusters R&I directions in core themes, then rates each of them according to a voting scale considering their importance and uncertainty

4
Prioritizing R&I topics
For each core theme, the group identifies, validates and scores the main challenges, delivering per each of them the main hazards and the relative list of prioritized topics and associated target actions.

5
Open Consultation
A survey to rank the R&I topics in terms of emergency and uncertainty is circulated in high-level expert networks and social networks and to collect input from a wider and diverse audience.

6
SRIA Finalization
After reviewing the consultation results, the working group finalizes the topics for the SRIA, by highlighting short-medium-long term effect and shares strategy and outcomes in a **consultation workshop** with policy-makers and institutions representatives.
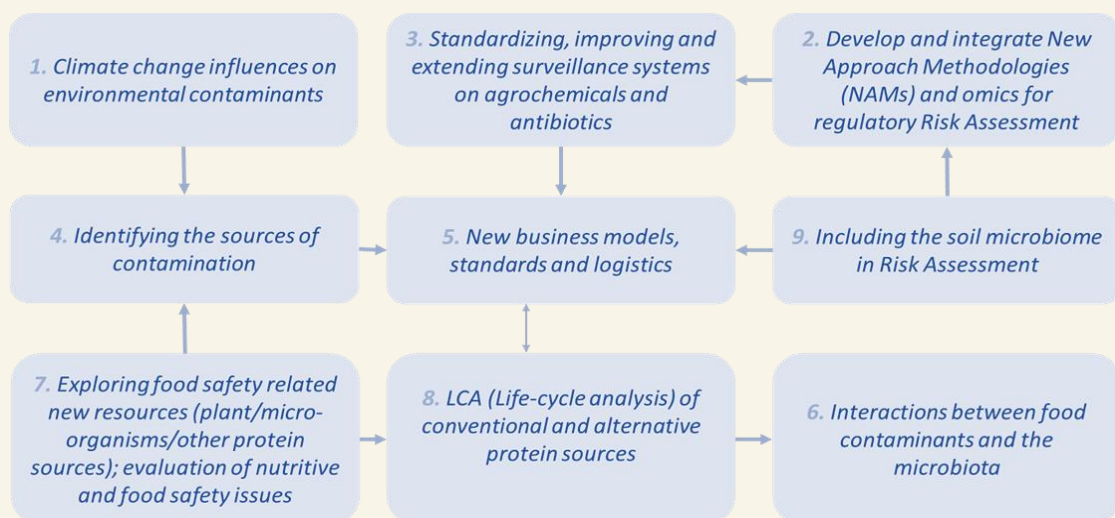
CHALLENGE 1: Climate change and food security

Food security, which is including food safety and nutritional security, is considerably affected by **climate change**. The quality of resources (soil health, water, agricultural production, etc.) poses also an alarming high risk.

The increased risk of higher temperatures with its consequences, and planetary water warming and acidification, lead to changing the existing microclimate that is coming with **new microbiological risks** such as the emergence of existing and new foodborne pathogens and parasites in fresh water and plants, as well as, e.g., the increasing incidence of harmful algal blooms. Drought and floods, that are becoming more frequent, are changing the microflora population with **potential new contaminants**. Floods are contributing to spread the pathogens and chemical contaminants from the places where they are accumulated. Some of the effects associated with climate change are likely to result in serious food safety issues such as an increased incidence of new mycotoxins-producing fungal species in maize in Europe or bioaccumulation of toxic metals in molluscs.

Climate change leads to **complex associations** with several food safety hazards, potentially leading to increased risks of foodborne illnesses and affecting access to safe and nutritious food for people. Therefore, approaches to **understand food systems under climate change** and how they can be transformed to ensure food security and food safety for all, while reducing their environmental footprint, need to be developed to ensure healthy and balanced diets for all.

Considering the relation between climate change and food safety, the following relevant topics were found by experts for the medium-term Action Plan, as it can be seen below.

Selected R&I topics relevant to the medium-term Action Plan on Climate change and food security

1. Climate change influences on environmental contaminants	3. Standardizing, improving and extending surveillance systems on agrochemicals and antibiotics	2. Develop and integrate New Approach Methodologies (NAMs) and omics for regulatory Risk Assessment
4. Identifying the sources of contamination	5. New business models, standards and logistics	9. Including the soil microbiome in Risk Assessment
7. Exploring food safety related new resources (plant/micro-organisms/other protein sources); evaluation of nutritive and food safety issues	8. LCA (Life-cycle analysis) of conventional and alternative protein sources	6. Interactions between food contaminants and the microbiota

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Expected outcomes in the medium term

Enhancing the multidisciplinary approach addressing climate related-risks. These topics are promoting research to co-create new knowledge and tools necessary to better predict, mitigate and adapt to these risks. It is obviously necessary to understand the inter-connected areas and processes to be in line with the strategic European documents, such as Green Deal and the Farm to Fork strategy for a fair healthy and environmentally friendly food system, as well as with the 2030 Agenda for Sustainable Development Goals and EU's climate ambition for 2030 and 2050.

Fostering R&I advances in developing, validating and standardizing new integrated approaches for risk assessment: To contribute to the transformation of food systems new integrated approaches are needed for detecting, assessing, and mitigating food safety risks influenced by climate change. The R&I topics will explore new resources for ensuring food and nutritional security while their sustainability and risks will be assessed.

Contribution to the implementation of co-approach participative process. All topics should involve all food system stakeholders that could address relevant contribution to the challenge: Climate change and food security. Foresight methodologies and monitoring and modelling existing data for anticipating the new hazards and risks that could occur along the food supply chain, as climate change effect have a major importance in mitigation and adaptation next future measures.

Understanding the climate change interlinked effects in relation with food and environmental safety. Elucidating the complex interactions between climate change and food and environmental safety by creating new knowledge and develop models by using the big existing data and using artificial intelligence.

Topics emergency vs uncertainty matrix
Prioritization of the 9 defined topics of the Climate change and food security challenge
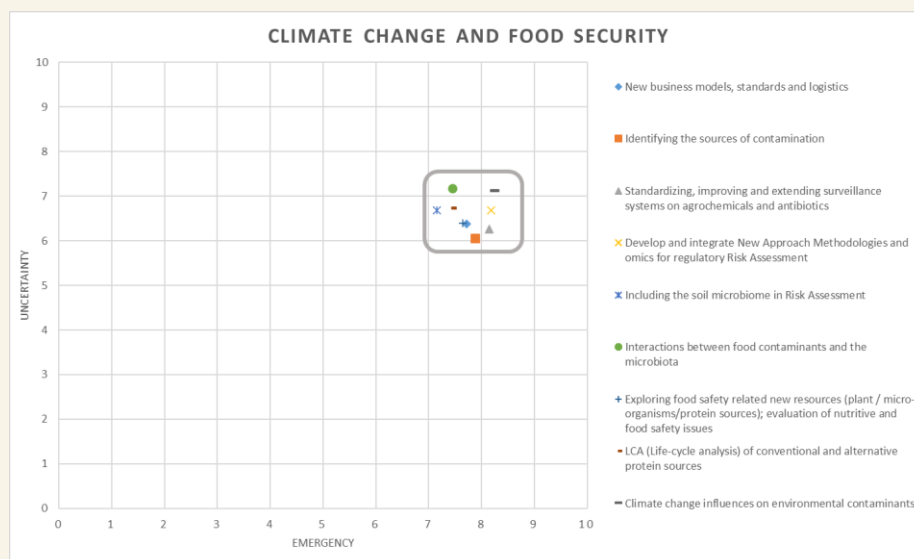
CHALLENGE 2: Food Supply Chain: Traceability & Transparency

Traceability determines how different flows of raw materials and agriculture inputs or processing aids, ingredients packaging, final products and other component or products impact the supply chain. **Traceability is at the base of food safety**, underpinning food quality, sustainability claims, and transactional mechanisms to prevent food fraud and food defense incidents. Food traceability across the supply chain is a key component of safe food which is an important dimension of food security. The current food traceability systems are challenged by frequent occurrences of food safety incidents and food recalls that have damaged consumer confidence, caused huge economic loss, and put pressure on food safety agencies.

Food systems and, especially, food supply chain, are becoming more complex within the globalization phenomenon that increases the number of actors involved, lengthens movement of perishable produces, and amplifies information variations in food supply chains. This complexity is coming also with challenges related to the transparency and traceability and interlinked food safety challenges. The need for food supply chain transparency, social responsibility, and accountability has increased substantially in the past few years. The starting point and the main problem of traceability in food processing results from the transformations that the resources go through.

Considering the relation between traceability and food safety, the several relevant topics were identified by experts for the short-term Action Plan, as shown below. They encompass actions to increase process transparency, security, and efficiency (including development of statistical data models, internal traceability systems, new digital technologies, cloud computing and blockchain-based approaches) as well as building trust among participants.

Selected R&I topics relevant to the short-term Action Plan on Food Supply Chain: Traceability & Transparency
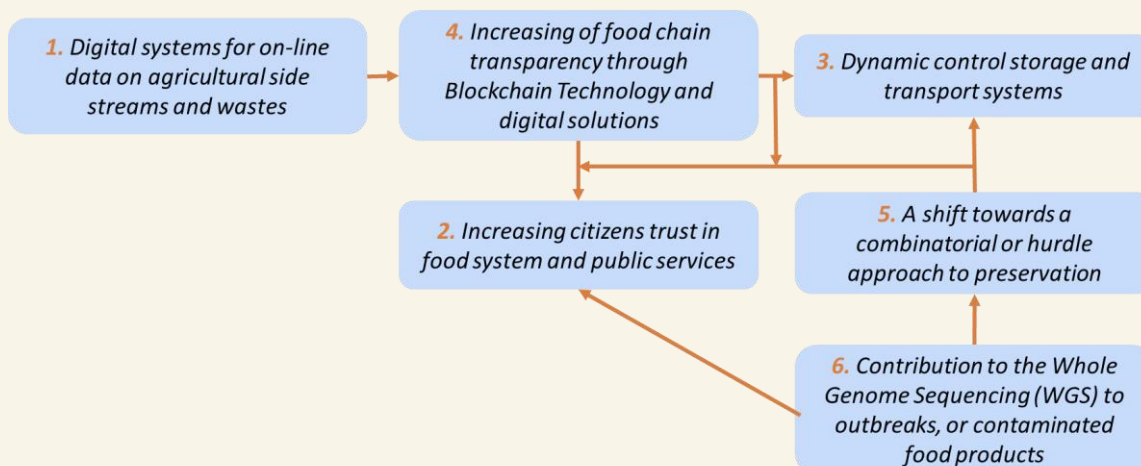
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Expected outcomes in the short term

Improving supply chain visibility. Transparency and traceability are the key components of supply chain visibility, which is growing ever more important in a globalized economy. These make the possibility to keep stakeholders informed of any changes promptly, while it allows to map out every tier of a supply chain through using the use of a multitude of sourced data.

Facilitating data interoperability. Transparency and traceability of the supply chain requires interoperability of data from different information systems, integration of data from different sources and automatic processing, by artificial intelligence.
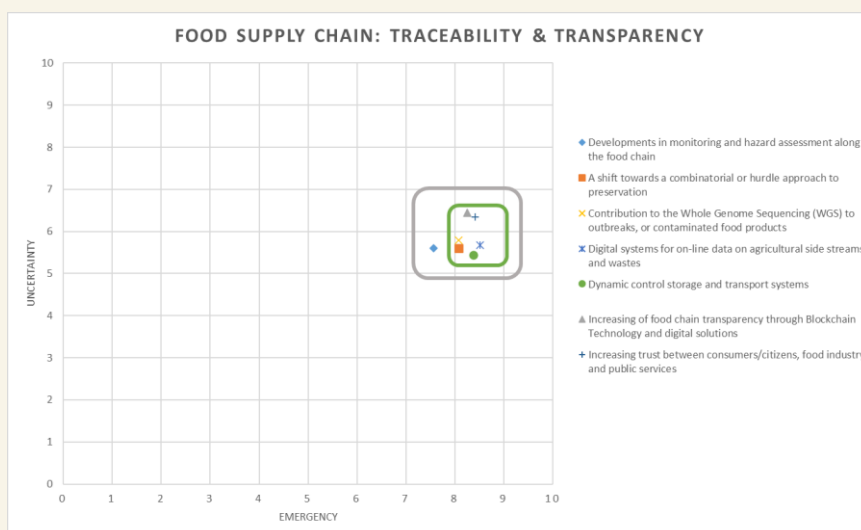
Enhancing the efficiency of certification quality systems. National and EU voluntary certification systems also need data from the specific food chain for their control, evaluation and, finally, product certification. By improving traceability & transparency of food system certification quality system sector could be more efficient and accurate, improving the quality of food market, contributing to the prevention of food fraud.

Improving of food policy in food safety and quality and product ID. Existing data and data interoperability are needed for policy and regulations (i.e., tracking of food products and use of pesticides). The data and its interoperability contribute to identify the impact of food safety in wellbeing and welfare as well as in healthy of environment and contribute in this way to the new policy framework approach.

Increasing consumer's trust in food system. Consumers are requesting transparency and traceability since the pre-pandemic world. They want to know who made their products and where, what technology is used (i.e., conventional, organic, low input, sustainable, etc.) and, especially transparency regarding the quality of raw materials and ingredients/inputs that are used.

Topics emergency vs uncertainty matrix
Prioritization of the 7 defined topics of the Food supply chain: Traceability & Transparency challenge

FOOD SUPPLY CHAIN: TRACEABILITY & TRANSPARENCY

- Developments in monitoring and hazard assessment along the food chain
- A shift towards a combinatorial or hurdle approach to preservation
- Contribution to the Whole Genome Sequencing (WGS) to outbreaks, or contaminated food products
- Digital systems for on-line data on agricultural side streams and wastes
- Dynamic control storage and transport systems
- Increasing of food chain transparency through Blockchain Technology and digital solutions
- Increasing trust between consumers/citizens, food industry and public services

CHALLENGE 3: Integration & Improving Risk Assessment Methodologies

Improved risk assessment shall include **integrated approaches and methodologies** to identify, characterize and manage chemical and biological risks, including antimicrobial resistance (AMR). Improved methodologies should also foster rapid risk assessment (RRA) for fast decision-making in new risk situations to support their management decisions.

Future research should support the shift towards testing strategies enabling reliable, **animal-free hazard and risk assessments** are needed. Predictive toxicology integrating in silico, in chemico and in vitro approaches named "New Approach Methodologies (NAMs)" to predict the potential toxicity and toxic potency of chemicals or drugs in humans, now forms the backbone of next generation risk assessment approaches (NGRA) that ensure human safety without performing animal testing.
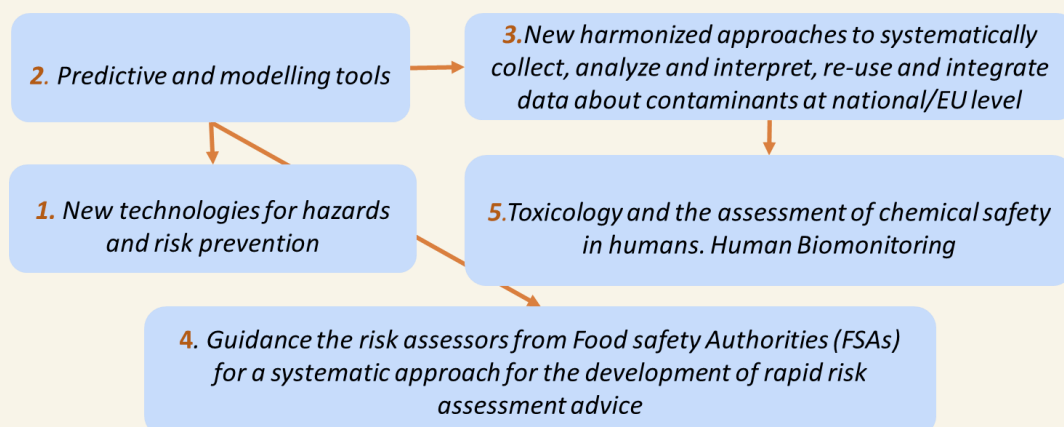
Predictive toxicology asks for **toxicological open data** of high quality, available in similar formats. Using **harmonized methods**, as well as application of **digital solutions** for data collection and access, will support consistency, transparency, and structured, reproducible risk assessments across all areas as well as further international cooperation between scientific advisory bodies across regulatory domains.

New knowledge in **human biomonitoring** and the implementation of **biomarker-based approaches** in risk assessment will provide a better understanding of interindividual variability in susceptibility.

Human biomonitoring plays also an essential role in environmental health and the assessment of pollution levels in the population, population groups or individuals, while environmental monitoring data are frequently unable to deliver exact results on the exposure of a single individual or the internal contamination of population groups. Human biomonitoring, environmental monitoring, and food monitoring should be seen as complementary.

Five topics were identified by experts for the short-term Action Plan to advance risk assessment, as shown below.

Selected R&I topics relevant to the short-term Action Plan on Integration & Improving Risk Assessment Methodologies

2. Predictive and modelling tools

3.New harmonized approaches to systematically collect, analyze and interpret, re-use and integrate data about contaminants at national/EU level

1. New technologies for hazards and risk prevention

5.Toxicology and the assessment of chemical safety in humans. Human Biomonitoring

4. Guidance the risk assessors from Food safety Authorities (FSAs) for a systematic approach for the development of rapid risk assessment advice

Expected outcomes in the short term

Improvements in risk assessment. The identified topics will improve risk assessment and predictive toxicology by fostering the implementation of non-animal testing methods to forecast the effects of a chemical on biological systems.

Facilitation of food system transformation. Improved risk assessment will support the food systems in becoming more resilient, sustainable, and capable to enable enough safe and nutritious food for a growing population in the context of climate change and limited resources.

Supporting public health protection. Systemic thinking and integration concept and risk-based food safety management system will support the development of novel solutions helping public health policy.
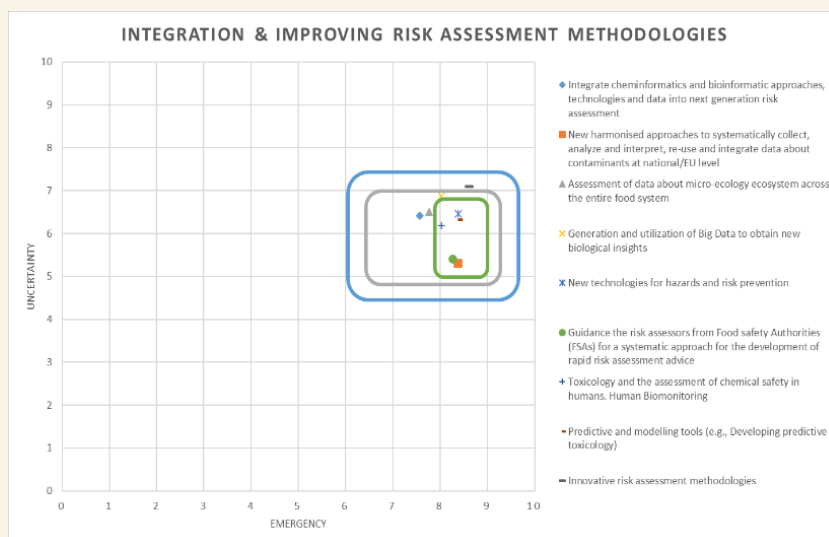
Contribution to digitalization will be achieved through the development of sensors, digital auditing tools, mobile solutions, predictive and modelling tools as well as new harmonized approaches to systematically collect, analyze and interpret, re-use and integrate data about contaminants at national/EU level.

Contribution to toxicology and chemical risk assessment. Increasing the research on human biomonitoring and implementing biomarker-based approaches in risk assessment will advance the understanding of interindividual variability in susceptibility to single and multiple contaminants.

Improving guidance for risk assessors in the implementation of the systemic approach for the development of rapid risk assessment advices. Development of tools and methodologies to support risk management and decision-making.

Topics emergency vs uncertainty matrix

Prioritization of the 9 defined topics of the Integration & Improving Risk Assessment Methodologies challenge

INTEGRATION & IMPROVING RISK ASSESSMENT METHODOLOGIES

♦ Integrate cheminformatics and bioinformatic approaches, technologies and data into next generation risk assessment

■ New harmonised approaches to systematically collect, analyze and interpret, re-use and integrate data about contaminants at national/EU level

▲ Assessment of data about micro-ecology ecosystem across the entire food system

✕ Generation and utilization of Big Data to obtain new biological insights

✕ New technologies for hazards and risk prevention

● Guidance the risk assessors from Food safety Authorities (FSAs) for a systematic approach for the development of rapid risk assessment advice

+ Toxicology and the assessment of chemical safety in humans. Human Biomonitoring

– Predictive and modelling tools (e.g., Developing predictive toxicology)

– Innovative risk assessment methodologies

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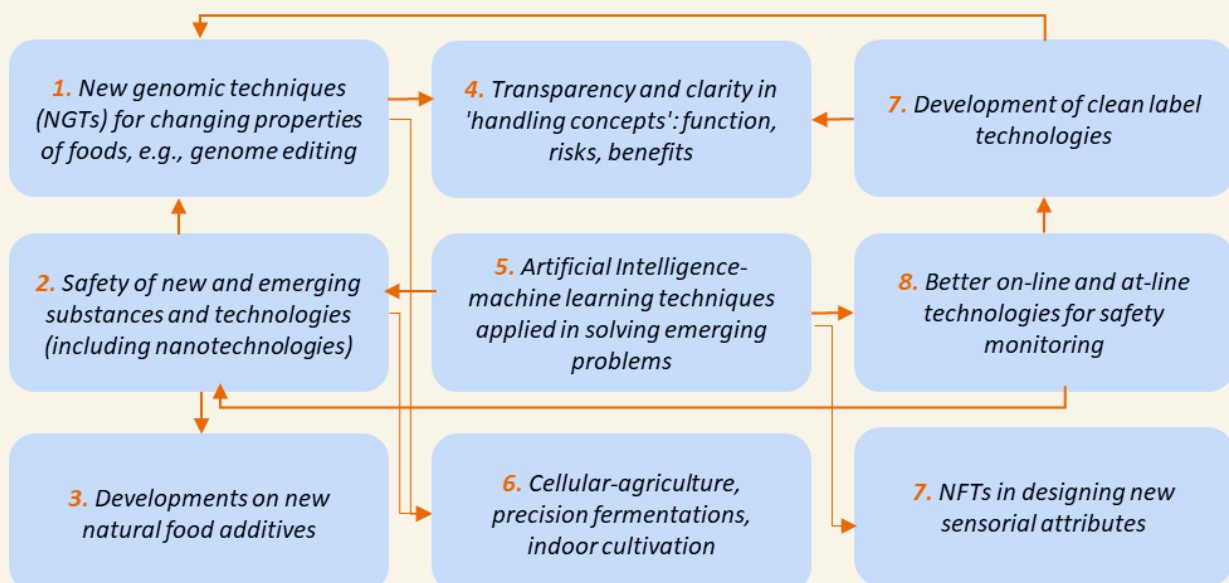## CHALLENGE 4: Rapid Technological Advancement & Emerging Technologies

Contaminated food by physical, biological, or chemical hazards can harm consumers, increasing demand for health services, government expenditure on public health and other social costs. The quality assurance programs are based on the continuous monitoring of raw matter, production process, storage, and distribution of the end products, including the purpose for which they are intended. Such programs represent an important objective for food producers, not only for the potential risk to human health, but also for the economic losses to which they can be subjected. The development and use of rapid analytical methods able to identify the main failures in food production can benefit food companies by saving time and costs for the good and fast control of products through the entire food chain.

However, food safety controls along the manufacturing line can increase the production costs for food industry, since often monitoring at critical control points, to comply with regulatory standards requires laboratory testing and lengthy times. Better on-line and at-line methodologies, based on fast responding methods (e.g. sensors) are needed to improve the sensitiveness, velocity, and response of those systems. e.g., mycotoxins in cereals, acrylamide.

Rapid detection methods can represent alternative technologies to the expensive, tedious, and time-consuming analytical techniques used for the monitoring and control of chemical contaminants in food products. Rapid, easy to implement and economically sustainable methods for reliable regulatory compliance testing and monitoring of the fate of contaminants along the process are requested.

Eight topics were identified by experts for the short-term Action Plan to improve rapid and reliable food safety controls, as shown below.

Selected R&I topics relevant to the short-term Action Plan on Rapid Technological Advancement & Emerging Technologies

1. New genomic techniques (NGTs) for changing properties of foods, e.g., genome editing	**4.** Transparency and clarity in 'handling concepts': function, risks, benefits	**7.** Development of clean label technologies
2. Safety of new and emerging substances and technologies (including nanotechnologies)	**5.** Artificial Intelligence-machine learning techniques applied in solving emerging problems	**8.** Better on-line and at-line technologies for safety monitoring
3. Developments on new natural food additives	**6.** Cellular-agriculture, precision fermentations, indoor cultivation	**7.** NFTs in designing new sensorial attributes

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Expected outcomes in the short term

Contribution to the improving of food safety control. The development of rapid methods will support the monitoring of food products, adding value and guaranteeing a more agile control of food safety and quality. Future research in this field is expected to address also sustainability since the use of these methodologies should reduce not only the time of analysis and loss of products, but also the chemicals required to perform the contaminants analysis.

Increased implementation of rapid testings along the control points in food industries.
Ensuring the safety of innovations in food production. The development and use of rapid analytical methods will contribute to the identification of the main failures in food production and enable the development of efficient decision support systems.
This will imply also the development of skills such as "Problem Solving" and "Critical Thinking" for a faster decision process on food materials and safety issues associated with them.

Topics emergency vs uncertainty matrix
Prioritization of the 9 defined topics of the Rapid Technological Advancements & Emerging Technologies challenge

RAPID TECHNOLOGICAL ADVANCEMENTS & EMERGING TECHNOLOGIES
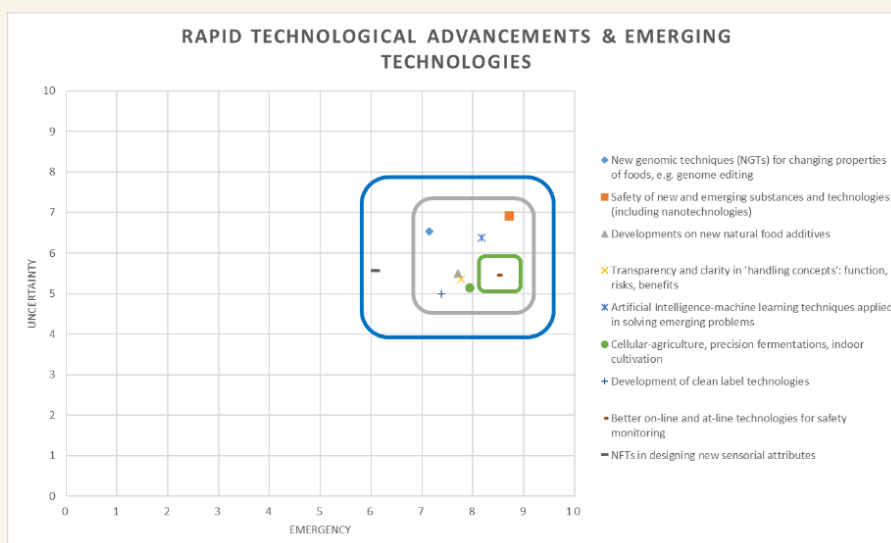
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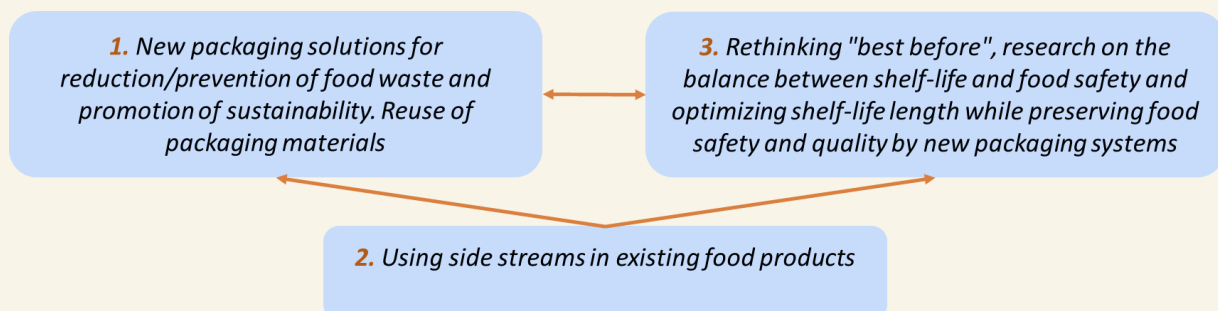
CHALLENGE 5: Sustainable Production/Processing

Sustainable Food Production/Processing is necessary to shape **resilient food systems** to equitably feed the growing global population in a challenging environment. Different aspects of a sustainable future food system must be analyzed and the micro-, meso-, and macro-level changes required to transform the way food is produced, processed, and consumed. New business models, technologies, and processes must be implemented for embedding sustainability into food supply chains, and build practical strategies for leading this transformation with the involvement of actors working at every stage of global or local food systems.

Agricultural professionals, including commercial and small-scale farmers, ranch managers, agricultural engineers or technicians, and agronomists must gain **practical tools** for delivering nutritious, affordable, and sustainable food to all. Those in the manufacturing, retail, wholesale, or service sectors, such as supply chain and procurement professionals, food and beverage managers, restaurateurs, and entrepreneurs aspiring to start a **sustainable business** must discover scalable models for achieving resilient food systems. And analysts, policymakers, consultants, and lobbyists working in finance, marketing, and public relations must learn how to clearly articulate the case for sustainable food production, processing, and consumption.

Environmental concerns are driving research and innovation in the food packaging sector to use renewable resources, namely **agri-food waste, and by-products** such as bagasse, pulps, roots, shells, straws, and wastewater for the extraction and isolation of biopolymers that are later transformed into packaging materials such as bioplastics, biofilms, paper, and cardboards, among others. In this context, the circular bioeconomy model is shown as a viable alternative for designing more sustainable production chains. Moreover, the **biorefinery** concept has been one of the main links between the agri-food chain and the food packaging industry.

Three different topics are included in this challenge for short term actions: retention of food quality with high nutritional values for health; circular economy; food packaging; assessment of new technologies for transforming the food system safely towards increased sustainability, as shown below.

Selected R&I topics relevant to the short-term Action Plan on Sustainable Production/Processing

1. New packaging solutions for reduction/prevention of food waste and promotion of sustainability. Reuse of packaging materials

3. Rethinking "best before", research on the balance between shelf-life and food safety and optimizing shelf-life length while preserving food safety and quality by new packaging systems

2. Using side streams in existing food products

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Expected outcomes in the short term

Contribution to the sustainability of food system. Future research will foster the development and implementation of innovative solutions for sustainable packages (f.i. recyclable paper bottle for liquid content and even carbonated beverages; innovative alternative to the traditional metal caps etc)

Facilitation of resources efficiency. The increasing need to re-use side streams from the agri-food industry will also impact the development of new food products. Using side streams in existing food products involves a series of operations: collection, transportation, logistics for agro-waste, processing, consumers acceptance.

Appropriate resources should be allocated to assess and monitor the safety along all those phases.

The processing of plant-based side streams should be cost-effective, and keeping the functionality of the products (e.g., nutritional value of proteins and antioxidant activity in polyphenols) to be successfully applied.

Topics emergency vs uncertainty matrix
Prioritization of the 11 defined topics of the Sustainable Production/Processing challenge
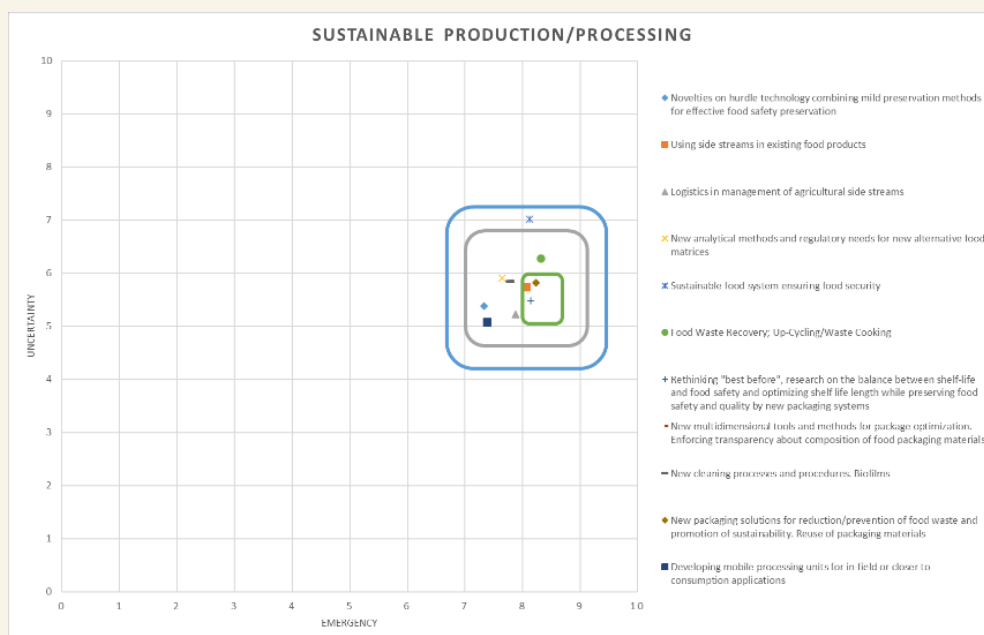
CHALLENGE 6: Ethics and One Health Systemic Approach

One Health is an integrative approach that connect welfare and wellbeing with human, animal, and environmental health. This is worldwide recognized **strategy** for expanding and promoting interdisciplinary integrations, collaborations, and communications in all aspects of healthcare for humans, animals, and the environment.

A One Health approach is crucial for achieving the global goal of food safety and security for all and is expected to improve health outcomes for every citizen. Implementing the One Health approach in food safety assessment and management will broaden the perspective by understanding the interlinkages of drivers and determinants for the emergence and persistence of human, animal, and environmental threats.

The key findings and conclusions of the "**ONE – Health, Environment & Society – EFSA Conference 2022**' mentioned that "*to address the growing complexity in science and society, new ways of working that connect and integrate knowledge, data and expertise across a wide range of disciplines, sectors and actors must be embraced and One Health provides a valuable conceptual framework for advancing food safety assessments by ensuring the delivery of more integrated, cross-sectoral and collaborative health assessments*".

The main principles of the One Health **conceptual framework** consist of an integrative and systemic approach, transdisciplinary exchanges, and collaboration with co-creation. Applying these principles to food safety and nutrition, across science, regulatory science and among regulators, would allow to deal with the increasing complexity and urgency of health and food safety challenges to be addressed. This will ensure the delivery of **more integrated, cross-sectoral, and collaborative health assessments** by putting the health of people, animals, plants, and their shared environment at its core.

The FS4EU multi-actor expert discussion revealed that approaching this concept in the near future remains challenging. Making available suitable tools and models to analyse the enormous quantity of existing **data** from the three domains (human, animal and environment health) to set up the bases of the future actions, and to enable integrated approaches for risk/benefit/cost assessment, was identified as a priority issue for the short term action plan, as shown below.

Selected R&I topics relevant to the short-term Action Plan on Ethics and One Health Systemic Approach

1. *Data handling tools for systemic approaches* ⟷ **2.** *Integrated approaches for risk/benefit/cost assessment*
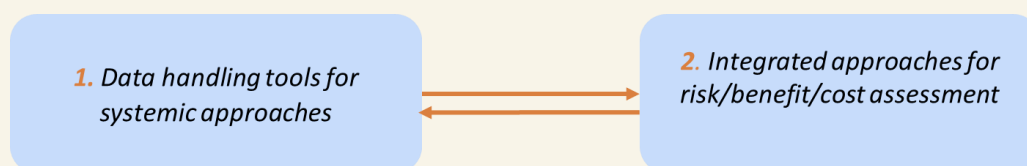
Expected outcomes in the short term

Supporting the triple goals: sustainability, nutritional security, and food safety. Nutritional security and food safety are two complementing human needs which should be assured within a sustainable food system. Integrated and systemic approaches in food safety research, embracing One Health principles, will support the sustainability achievement according the United Nations sustainable development goals (SDG) including eradication of hunger and poverty, clean water, sustainable land use, responsible production, and consumption, mitigating climate change, and sustainable life on land and water without compromising food safety (e.g., free of contaminants and a transparent food system by controlling the food frauds).
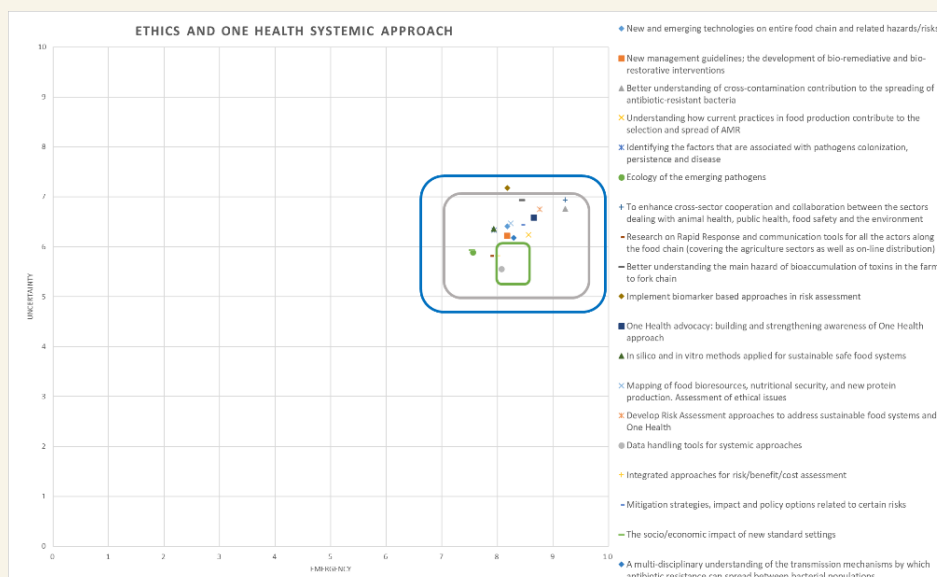
New approaches in risk assessment through One Health perspective. Embedding the One Health perspective in the risk analysis conceptual framework will boost inter-agency cooperation as well as the integration of human (including nutritional and safe food)-animal-environmental health sciences as basis for evidence-based food safety decisions

Enhanced implementation of multidisciplinary and transdisciplinary approaches. One Health concept, taking on board human, animal, and environmental health sciences, requires multidisciplinary and transdisciplinary approaches. Looking to the complexity of food system and embracing the One Health concept, multidisciplinary and transdisciplinary cooperation should be envisaged in future research.

Supporting the needs of Food System Stakeholders active engagement. Undertaking complex food safety issues requires the active engagement of all food system stakeholders. Through smart cooperation and collaboration, finding the complementarities and synergies between them, food system stakeholders.

Topics emergency vs uncertainty matrix
Prioritization of the 19 defined topics of the Ethics and One Health Systemic Approach challenge

ETHICS AND ONE HEALTH SYSTEMIC APPROACH

- ◆ New and emerging technologies on entire food chain and related hazards/risks
- ■ New management guidelines; the development of bio-remediative and bio-restorative interventions
- ▲ Better understanding of cross-contamination contribution to the spreading of antibiotic-resistant bacteria
- ✕ Understanding how current practices in food production contribute to the selection and spread of AMR
- ✳ Identifying the factors that are associated with pathogens colonization, persistence and disease
- ● Ecology of the emerging pathogens
- ＋ To enhance cross-sector cooperation and collaboration between the sectors dealing with animal health, public health, food safety and the environment
- − Research on Rapid Response and communication tools for all the actors along the food chain (covering the agriculture sectors as well as on-line distribution)
- − Better understanding the main hazard of bioaccumulation of toxins in the farm to fork chain
- ◆ Implement biomarker based approaches in risk assessment
- ■ One Health advocacy: building and strengthening awareness of One Health approach
- ▲ In silico and in vitro methods applied for sustainable safe food systems
- ✕ Mapping of food bioresources, nutritional security, and new protein production. Assessment of ethical issues
- ✳ Develop Risk Assessment approaches to address sustainable food systems and One Health
- ◉ Data handling tools for systemic approaches
- ＋ Integrated approaches for risk/benefit/cost assessment
- − Mitigation strategies, impact and policy options related to certain risks
- − The socio/economic impact of new standard settings
- ◆ A multi-disciplinary understanding of the transmission mechanisms by which antibiotic resistance can spread between bacterial populations

CHALLENGE 7: Science-based Decision Making

Science-based decision making refers to topics/actions aimed at translating science outcomes into input for policies, supporting a constant political commitment to foster safe and sustainable food systems. These inputs are intended to be uptaken in policy and R&I frameworks such as the EU Green Deal and more specifically the Farm to Fork strategy, the strategy for sustainable Chemicals and the Biodiversity strategy. **Science-for-policy research** fosters the evolution of the EU regulatory framework to integrate sustainability into all food-related policies. It also formulates topic/actions intended to exploit scientific knowledge (data, results) to deliver new and improved policies, standards, guidelines, recommendations. While the concept of evidence-based decision-making may seem straightforward, its implementation is far more intricate. Evidence encompasses diverse forms, and deliberate selectivity can be employed to support a particular stance. Thus, **true evidence-based decision-making** necessitates the synthesis of all accessible evidence. However, it is crucial to acknowledge that not all evidence syntheses are robust and can introduce biases. Additionally, the validity of individual empirical studies varies.

An important pre-requisite, for science-based decision making, was identified in the availability of **harmonized standardization frameworks** and processes, also with a view of the incoming sustainability framework.

The short term action plan for this challenge, as shown below, should address the development of approaches and roadmaps to establish or update internationally recognized **food safety standards** (at EU and global level). This harmonization would be an enabling factor when translating scientific evidence into **recommendations for risk management** by complementing it with the evaluation of the socio-economic impact of the proposed measures.

Selected R&I topics relevant to the short-term Action Plan on Science-based Decision Making

1. The establishment of EU/global food safety standards

2. A comprehensive framework for determining the burden of foodborne diseases

Expected outcomes in the short term

Enhancing consumer safety. The establishment of EU/global food safety standards, coupled with a comprehensive burden framework and regulation of genome engineering methods, is expected to ensure higher levels of consumer safety by minimizing the risk of foodborne diseases and ensuring the safety of genetically engineered food products.

Improving public health. The comprehensive burden framework, along with standardized surveillance systems on antibiotic use and resistance, will allow for a better understanding of the burden of foodborne diseases and the spread of antibiotic resistance enabling targeted interventions, improved risk management, and the development of effective mitigation strategies.

Responsible and ethical use of genome engineering. Through the regulation of genome engineering methods, there is a focus on responsible and ethical use of these technologies. Genetically engineered food products meeting safety and ethical standards will foster consumer trust and promote the sustainable development of the food industry.

Global harmonization and collaboration. The international harmonization of food system sustainability policy advises will foster global collaboration and cooperation, promoting the sharing of best practices, the exchange of information, and the trans-national alignment of policies and regulations.

Integrated and systemic thinking. Building and improving transdisciplinary expertise and promoting the understanding of the advantages and limitations of food systems analysis will encourage integrated and systems thinking leading to holistic decision-making, identifying opportunities for innovation, optimizing resource allocation, and addressing sustainability challenges in a comprehensive manner.

Evidence-based decision making. The combination of all these initiatives will support evidence-based decision making across the food system. By integrating scientific research, data analysis, and rigorous risk assessments, decision-makers can make informed choices grounded in evidence to ensure food safety, sustainable practices, and public health outcomes.

Topics emergency vs uncertainty matrix
Prioritization of the 7 defined topics of the Science - Based Decision-making challenge
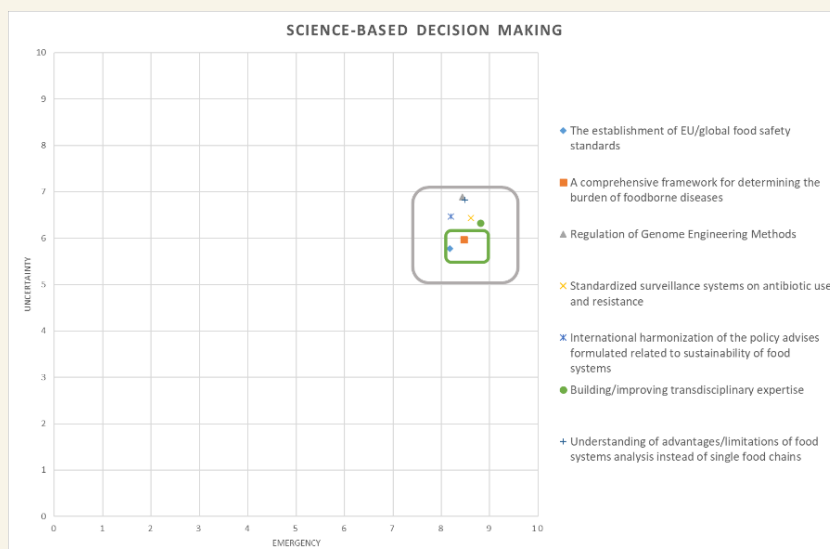
CHALLENGE 8: Food Safety Related Issues and Sharing Information & Resources

Food safety trends are significantly influenced by external factors, especially consumer demands.
The food industry is a service-oriented business that continuously finds ways to sustain the needs and wants of consumers while protecting them from potential harm. It is the responsibility of every food business to implement food safety systems that will ensure safe food production.

In a world where food safety takes the center stage, the **exchange of information and resources** becomes a vital narrative. The collective efforts of stakeholders (i.e., government agencies, international organizations, industry associations, research institutions, consumer advocacy groups etc.) are dedicated to sharing valuable insights, forming an intricate network of cooperation. Together, they educate the public, empower individuals, and enhance industry practices.

Online platforms and digital communities serve as the modern storytellers, disseminating valuable insights through websites, blogs, and social media channels. Through these collective efforts, a culture of food safety blooms, protecting the well-being of communities and ensuring that every meal is a tale of health and security.

To stimulate this food safety culture, friendly and cost-effective devices for in house control of contamination should be made available in the near future, by exploiting and further developing existing technologies. On the other side education and training programmes to build **transdisciplinary knowledge** and experience for scientists (risk assessors) and decision makers (risk managers) to enhance collaboration and enable a more informed and effective risk management strategies and policies, as shown below.

Selected R&I topics relevant to the short-term Action Plan on Food Safety Related Issues and Sharing Information & Resources

1. Consumers fast alert, quick, reliable, efficient, cheap methods of analyses and control

2. Programmes to build transdisciplinary knowledge for scientists (risk assessors) and decision makers (risk managers)

Include, shape, act!

Expected outcomes in the short term

Improved consumer safety and protection by the implementation of fast, reliable, efficient, and cost-effective methods of analyses and control.

Enhanced transdisciplinary knowledge and collaboration through programmes designed to build transdisciplinary knowledge for scientists, risk assessors, and decision-makers.

Timely and proactive response to food safety incidents by encouraging responsiveness to requests for information and promoting proactive reporting of food safety incidents.

Effective risk communication and combatting fake news by leveraging social and commercial media platforms for risk communication to enhances the dissemination of accurate and timely information to the public, while addressing misinformation.

Stakeholder cooperation and harmonization by promoting harmonization of reporting systems and databases fostering a more coordinated approach to food safety.

Social science research for effective risk communication. understanding public perceptions, attitudes, and behaviors enabling the development of targeted and tailored communication approaches for different audiences, increasing the likelihood of risk messages being understood and followed.
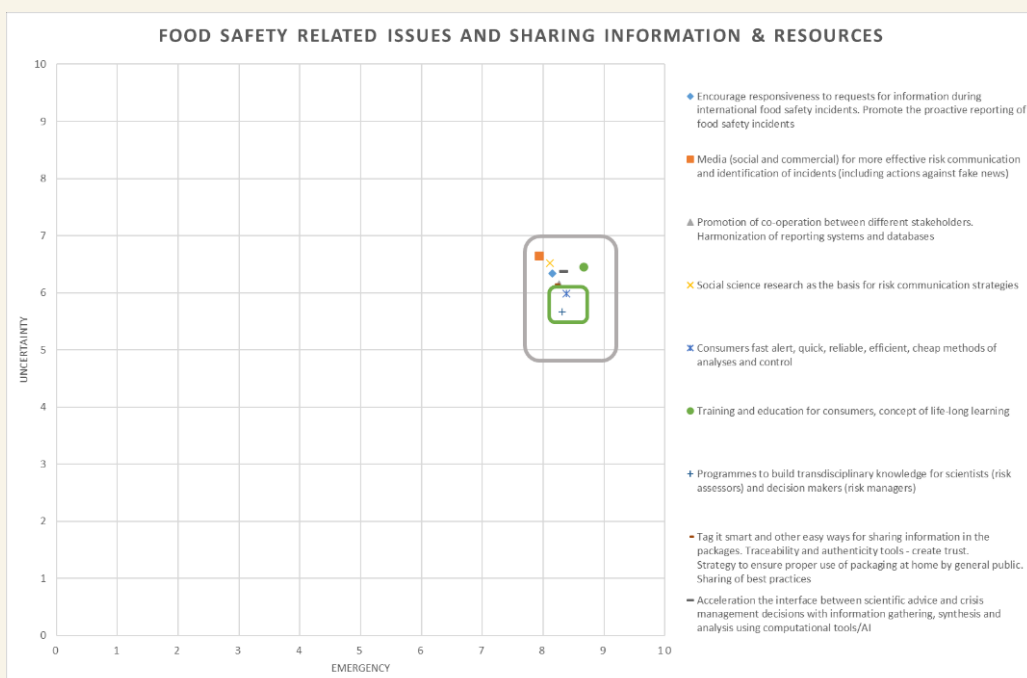
Empowering consumers through education and lifelong learning. training and education initiatives for consumers, emphasizing the concept of lifelong learning, empower individuals to make informed choices regarding food safety.

Smart packaging for information sharing and trust. implementing smart packaging technologies (i.e. tag it smart, traceability tools) will enhance information sharing and create trust and in the supply chain.

Accelerated scientific advice and crisis management by promoting the integration of computational tools and artificial intelligence (AI) in the interface between scientific advice and crisis management for faster information gathering, synthesis, and analysis.

Topics emergency vs uncertainty matrix

Prioritization of the 9 defined topics of the Food Safety Issues and sharing Information and Resources

FOOD SAFETY RELATED ISSUES AND SHARING INFORMATION & RESOURCES

◆ Encourage responsiveness to requests for information during international food safety incidents. Promote the proactive reporting of food safety incidents

■ Media (social and commercial) for more effective risk communication and identification of incidents (including actions against fake news)

▲ Promotion of co-operation between different stakeholders. Harmonization of reporting systems and databases

✕ Social science research as the basis for risk communication strategies

✶ Consumers fast alert, quick, reliable, efficient, cheap methods of analyses and control

● Training and education for consumers, concept of life-long learning

✛ Programmes to build transdisciplinary knowledge for scientists (risk assessors) and decision makers (risk managers)

– Tag it smart and other easy ways for sharing information in the packages. Traceability and authenticity tools - create trust. Strategy to ensure proper use of packaging at home by general public. Sharing of best practices

– Acceleration the interface between scientific advice and crisis management decisions with information gathering, synthesis and analysis using computational tools/AI

FoodSafety4EU
MULTI-STAKEHOLDER PLATFORM FOR FOOD SAFETY IN EUROPE

SRIA

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THE FS4EU SRIA IN A NUTSHELL

Areas of intervention and topics in the short-term perspective	Food Safety Challenges
1. Reducing food loss and waste	
Digital systems for on-line data on agricultural side streams and wastes	
	2.Food Supply Chain: Traceability & Transparency
New packaging solutions for reduction/prevention of food waste and promotion of sustainability. Reuse of packaging materials	
Using side streams in existing food products	
	5.Sustainable Production/Processing
2. Citizens trust	
Consumers fast alert, quick, reliable, efficient, cheap methods of analyses and control	
	8.Food Safety Related Issues and Sharing Information & Resources
Increasing citizens trust in food system and public services	
	2.Food Supply Chain: Traceability & Transparency
3. Food chain transparency	
Better on-line and at-line technologies for safety monitoring	
	4.Rapid Technological Advancement & Emerging Technologies
Dynamic control storage and transport systems	
Increasing of food chain transparency through Blockchain Technology and digital solutions	
	2.Food Supply Chain: Traceability & Transparency
4. Food preservation	
A shift towards a combinatorial or hurdle approach to preservation	
	2.Food Supply Chain: Traceability & Transparency
Better on-line and at-line technologies for safety monitoring	
	4.Rapid Technological Advancement & Emerging Technologies
5. Hazard and risk prevention	
A comprehensive framework for determining the burden of foodborne diseases	
	7.Science-based Decision Making
Contribution to the Whole Genome Sequencing (WGS) to outbreaks, or contaminated food products	
	2.Food Supply Chain: Traceability & Transparency
New technologies for hazards and risk prevention	
Predictive and modelling tools	
	3.Integration & Improving Risk Assessment Methodologies
6. Data integration	
Data handling tools for systemic approaches	
Integrated approaches for risk/benefit/cost assessment	
	6.Ethics and One Health Systemic Approach
New harmonized approaches to systematically collect, analyze, and interpret, re-use and integrate data about contaminants at national/EU level	
Predictive and modelling tools	
	3.Integration & Improving Risk Assessment Methodologies
7. Systemic apporach for risk assessment	
Guidance the risk assessors from Food safety Authorities (FSAs) for a systematic approach for the development of rapid risk assessment advice	
	3.Integration & Improving Risk Assessment Methodologies
Programmes to build transdisciplinary knowledge for scientists (risk assessors) and decision makers (risk managers)	
	8.Food Safety Related Issues and Sharing Information & Resources
8. Packaging systems	
Rethinking "best before", research on the balance between shelf-life and food safety and optimizing shelf-life length while preserving food safety and quality by new packaging systems	
	5.Sustainable Production/Processing
9. EU/Global Food Safety standards	
The establishment of EU/global food safety standards	
	7.Science-based Decision Making

The SRIA could have an impact to enhance food safety science, build trust in the **EU Food Safety System**, and address global challenges. It will contribute at

–   boosting Food Safety in the Food System, and in its transition towards sustainable food productions,
–   unravelling the food safety challenges (re)-emerging from technological innovations,
–   addressing citizens' concerns and expectations,
–   supporting regulatory science and science-based decision-making for food safety policies.

It also encourages collaborative efforts among researchers, businesses, civil society, and policymakers, impacting how advanced knowledge will be generated and shared.

The FS4EU SRIA, prepared through a multi-actor participatory process, provides a structured yet flexible framework for engaging diverse stakeholders in the co-creation of solutions for complex challenges in the context of the EU Food Safety System.

Food Safety 4EU

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