



# **Implementing new tools and techniques in food safety risk assessment, a UK experience**

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# UK Food Standards Agency



We are an independent non-Ministerial government department working to protect public health and consumers' wider interests in relation to food



Our role covers food and feed safety and consumer interests in food across novel food/feed, microbial, chemical, radiological and allergy risks



Our work is underpinned by the latest science and evidence and we look to improve our tools and techniques in risk assessment to better regulate

# Science at the heart of FSA



- Develop the evidence to underpin food safety policy and standards



- Understanding consumers and our wider society



- Adapting to the food system of the future

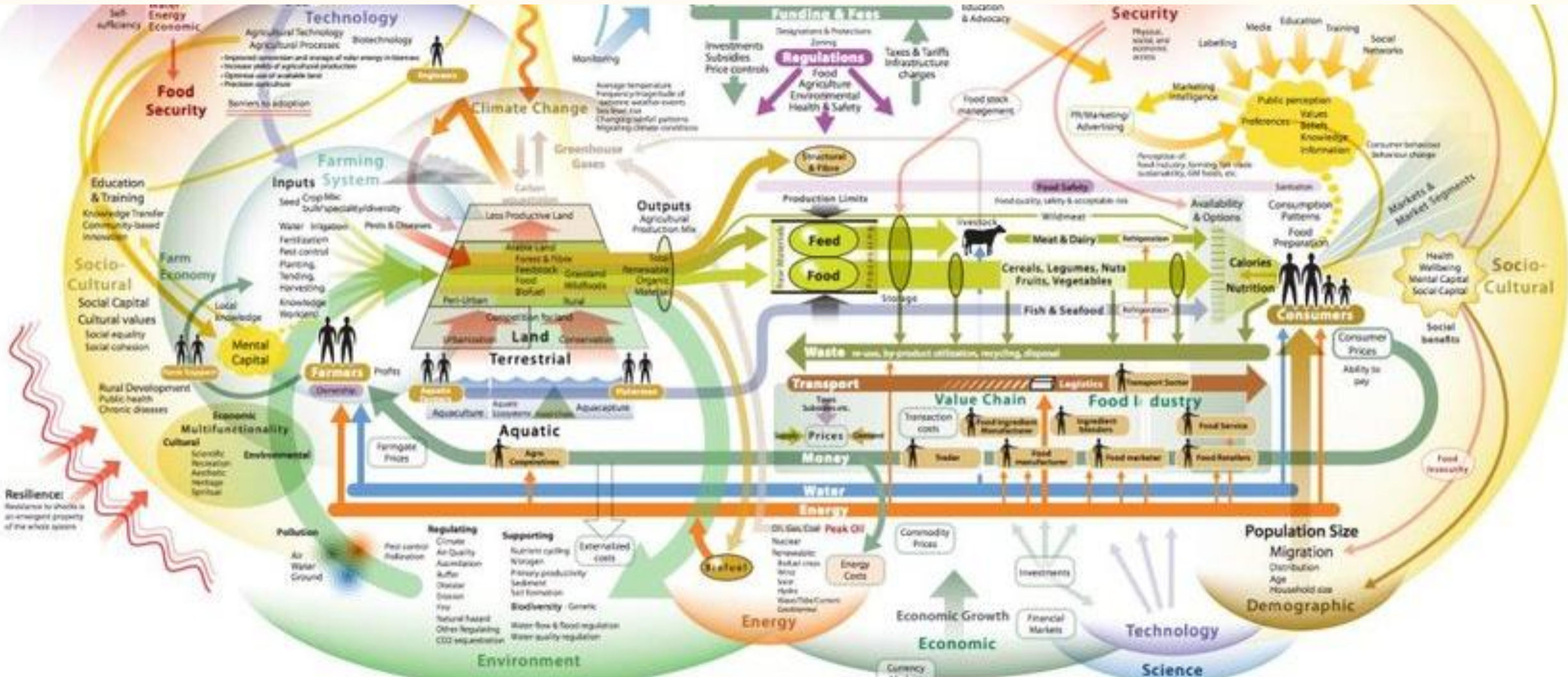


- Addressing the links between global grand challenges and the food system

# Four Country



# Complexities of the food system



# Contents

- Incorporating **advanced diagnostics** into surveillance
- **Biomarkers of exposure** into our dietary survey
- Use of **regulatory sandboxes**
- **AI** and signal processing
- Case study using **New Approach Methodologies**

# Advanced diagnostics in surveys

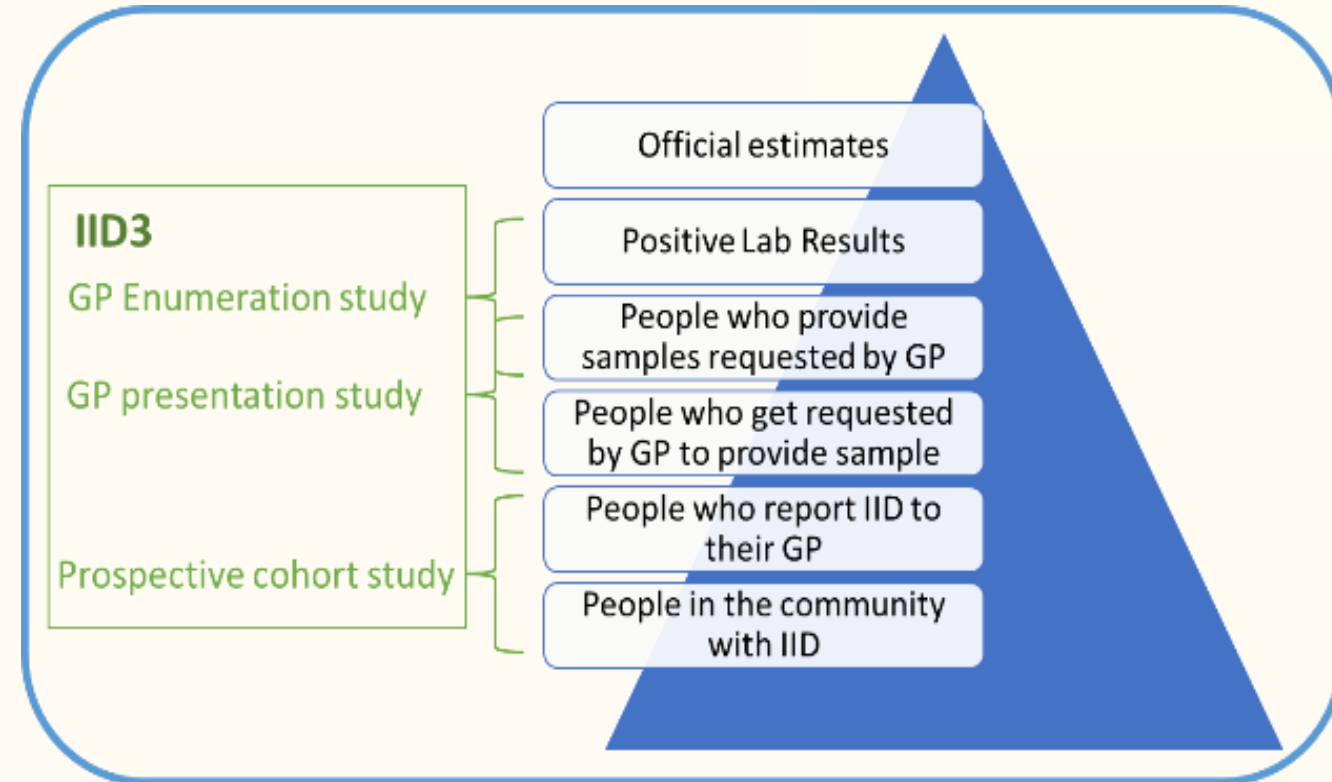
## Key aims

- True prevalence in the UK and key causes?
- What underreporting factors?
- What proportion of cases are likely foodborne?

## Background

- Latest UK-wide population study
- Designed to address under-ascertainment and changing epidemiology of GI infections
- 3<sup>rd</sup> iteration of this survey
- Large number of collaborative institutions

[Real time link: Microsoft Power BI](#)



# Advanced diagnostics in surveys



## Enhanced Sampling

Community and  
GP recruitment  
Complete view of  
unreported and  
reported cases



## Advanced Multiplex PCR

+ Multi-pathogen  
detection,  
identification of  
co-infection  
Higher sensitivity  
→ improved case  
detection



## Metagenomics Pilot

+ Detects all  
pathogens (not  
panel-limited),  
including those  
that are novel or  
rare  
Strain level insights  
(e.g., virulence, AMR)



## Smarter risk assessment

→ Updated  
prevalence  
estimates  
Improved Hazard  
ID  
Stronger data for  
source attribution

# Biomarkers of exposure



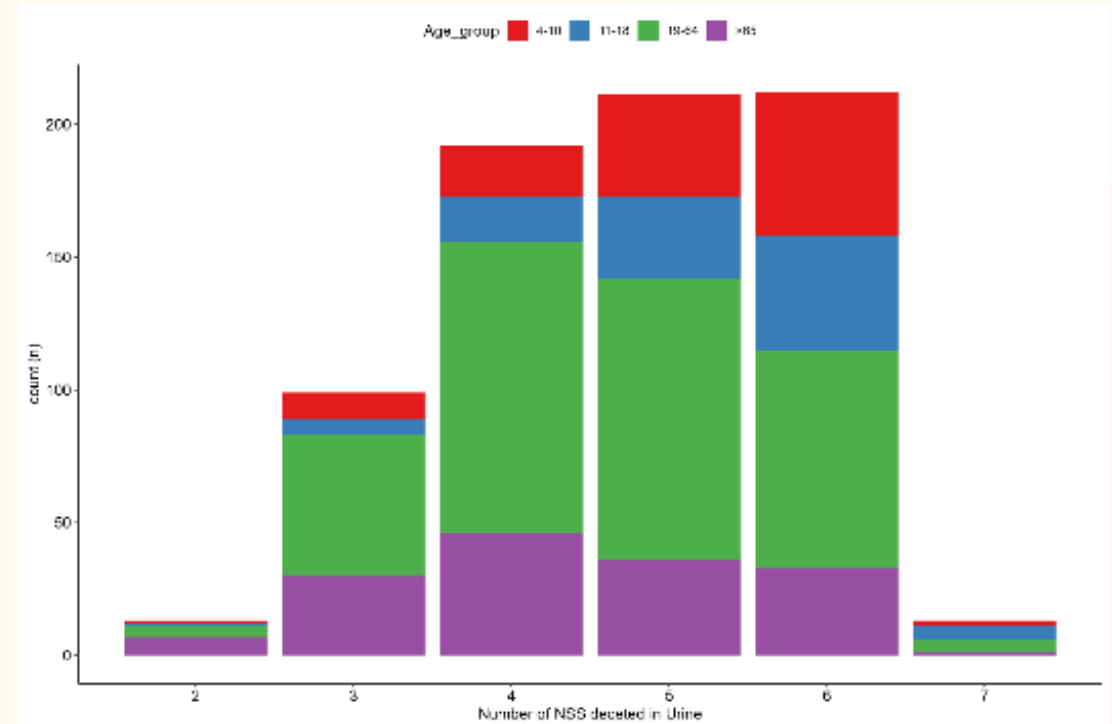
- Food Additives are approved based on a safety assessment which determines the maximum safe use
  - Actual use may be lower and true exposures are difficult to estimate
  - National Diet and Nutrition Survey (NDNS) Biological samples are stored for future research
- FSA proof of concept research project based on sweeteners, in collaboration with University of Cambridge:
    - Analysis of urine samples for biomarkers of sweeteners
    - Estimation of intake from measured excretion, based on ADME profile
    - Analysis by population groups (age, sex, BMI, ethnicity etc.)



# Biomarkers of exposure

## Analysis of:

- ✓ Acesulfame
- ✓ Sucralose
- ✓ NA Cyclamate
- ✓ Saccharin
- ✓ Polyols - Mannitol/Sorbitol and Xylitol/Arabitol
- ✗ Aspartame as no reliable biomarker  
- Look at acesulfame as indicator



## Indicative Findings:

- >85% of samples had 4 or more sweeteners detectable
- Evidence of associations between exposure and **age** (negative), **BMI** (positive), **sex** (males)
- Move from spot samples to 24 samples within national diet survey, add contaminants

# Regulatory sandbox

Cell-cultivated products (CCPs) are a novel regulatory challenge for the food system, that pose unique safety risks and complex regulatory questions.



## Safety

What are the safety risks & how do we mitigate them?



## Current Frameworks

How do current legal frameworks and guidance apply?

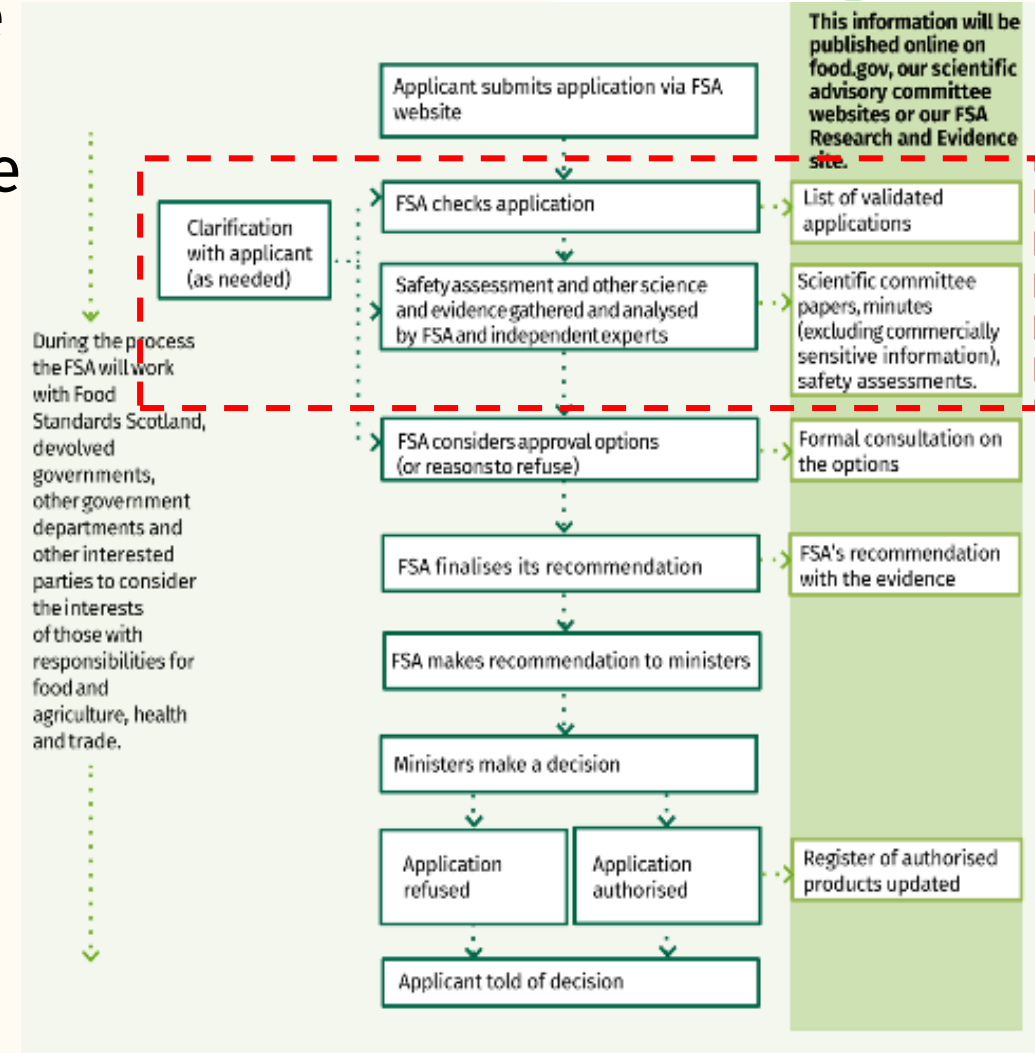


## Industry Knowledge

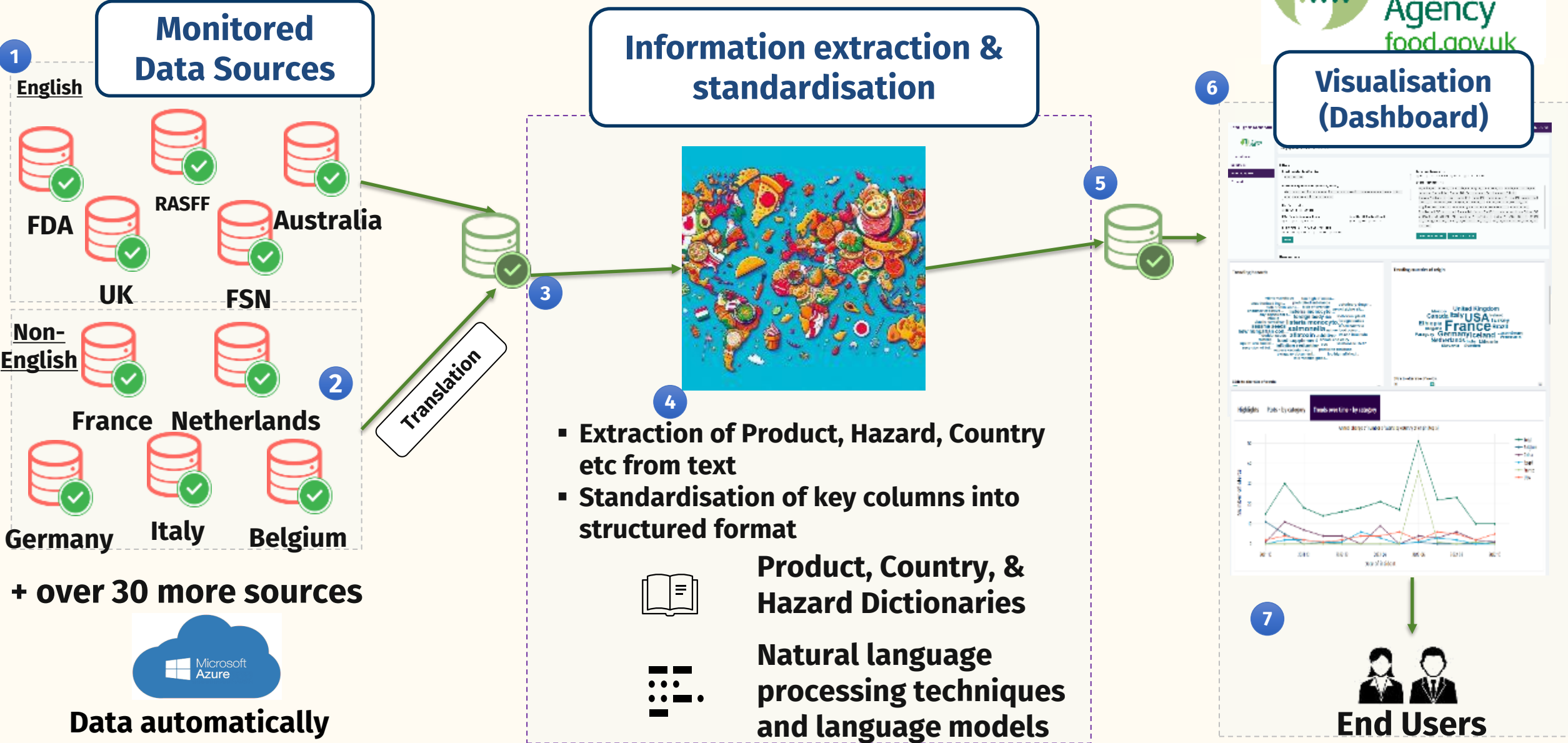
What is required of applicants to demonstrate safety?

# Regulatory sandbox

- Collaborative workshops with academics, trade bodies and industry representatives to understand new products, current best practice and key gaps
- Developing supplemental guidance tailored to the hazards, and appropriate mitigations
- Launching Business Support Service to provide clarification on the regulatory framework
- Providing 'tiered' requests for information, to enable risk assessment progression whilst additional data are generated
- Internal organisation changes to prevent regulatory capture



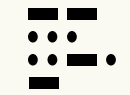
# AI signal processing



- Extraction of Product, Hazard, Country etc from text
- Standardisation of key columns into structured format



Product, Country, & Hazard Dictionaries



Natural language processing techniques and language models

# AI signal processing

Azure translate for translating text into English

TensorFlow sentence encoder generates sentence embeddings to match products and hazards against pre-set dictionaries

BERT ("encoder-only" transformer architecture – does not generate text) model for classifying signals as food or feed or food contact materials



Part-of-speech tagging for pattern matching



# AI signal processing



- **Saw increasing trend in the number of global alerts raised for Listeria in enoki mushrooms**
- **No outbreaks of listeriosis linked to Enoki mushrooms had been reported in the UK**
- **So, testing was undertaken by port health and local authorities, and they detected high levels of Listeria**
- **Risk assessments were updated and preventative measures were implemented**

# Computational toxicology



- New Approach Methodologies (NAMs) offer alternatives to traditional animal testing for priority-setting and safety assessment of food contaminants
- **In silico modelling** – computational predictions of toxicity, metabolism and exposure
- **In vitro assays** – cell-based testing to identify hazards and characterise dose-response
- **'Omics technologies** – genomics, transcriptomics and metabolomics to reveal mechanisms of action
- Case study: tropane alkaloids as potential food contaminants
- Collaborative international project with APCRA and academic partners:
  - Target identification – hypothesised MoAs
  - Molecular docking
  - Predict potencies using QSAR
  - Rank the list

# Computational toxicology



Potency Prediction of Muscarinic Acetylcholine Receptors (M1-M5)

Contour Diagrams	Tropane Alkaloid	(M1)	(M2)	(M3)	(M4)	(M5)	Blood Brain Barrier Permeability
	Atropine	✓	✓	✗	✓	✓	✓
	2-Hydroxymethyl atropine	✓	✓	✓	✓	✓	✓
	(-)-Scopolamine	✓	✓	✓	✓	✓	✓
	Anisodine	✓	✓	✓	✓	✓	✓
	Aposcopolamine	✓	✓	✓	✓	✓	✓
	Convolamine	✓	✓	✗	✓	✓	✓
	Fillalbine	✓	✗	✗	✗	✓	✓
	Convolamine	✗	✓	✓	✓	✓	✓
	O-acetylscopolamine	✗	✓	✗	✓	✓	✓
	(-)-Norscopolamine	✗	✓	✗	✗	✓	✓

\*TAs with a predicted  $pIC_{50} > 7.0$  against at least one of the muscarinic receptors were shortlisted

\*\*Blood-Brain Barrier Permeability prediction is a result of a binary (classification) model



Next steps:

Tier 2: Test potencies in vitro  
 Tier 3: Confirm MoA in 'omics studies and derive point of departure

Tier 4: using human toxicology data, conduct PBPK modelling to derive health based guidance value.

e Silva, A.D.C., Loizou, G., McNally, K., McDonald, D., He, S., Kalian, A., Osborne, O., Potter, C., Colbourne, J. and Viant, M., 2025. P12-06 Utilising in silico, in vitro and 'omics New Approach Methodologies (NAMs) for priority-setting and safety assessment of tropane alkaloids as potential food contaminants. *Toxicology Letters*, 411, p.S138.



# Key takeaways

- The food system is complex with interdependent and changing connections
- Consumers diets change and other system features such as healthcare behaviours and diagnostics
- Our risk assessment tools must keep pace
- No single tool – technology does it all
- Success lies in choosing the right tool for the right problem
- Strength of collaborating across partners and disciplines

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**Thank you for  
listening  
Any questions?**

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