FOODAKAI

KEY FOOD SAFETY TRENDS IN 2023:

Which are the top-10 emerging risks that AI models predict?

June 2023

Agroknow

About

Which are the top emerging risks and food safety trends that AI models are predicting for the next months?

What do experienced food safety leaders think about them?

Every week, FOODAKAI's AI models are generating forecasts for emerging food safety incidents globally.

This report presents these AI-powered forecasts for 10 product and ingredient categories.

For each category, the AI forecasts are contrasted to the opinion of human experts.

An explanation of how these AI-powered predictions are being produced is also included.

Contributors

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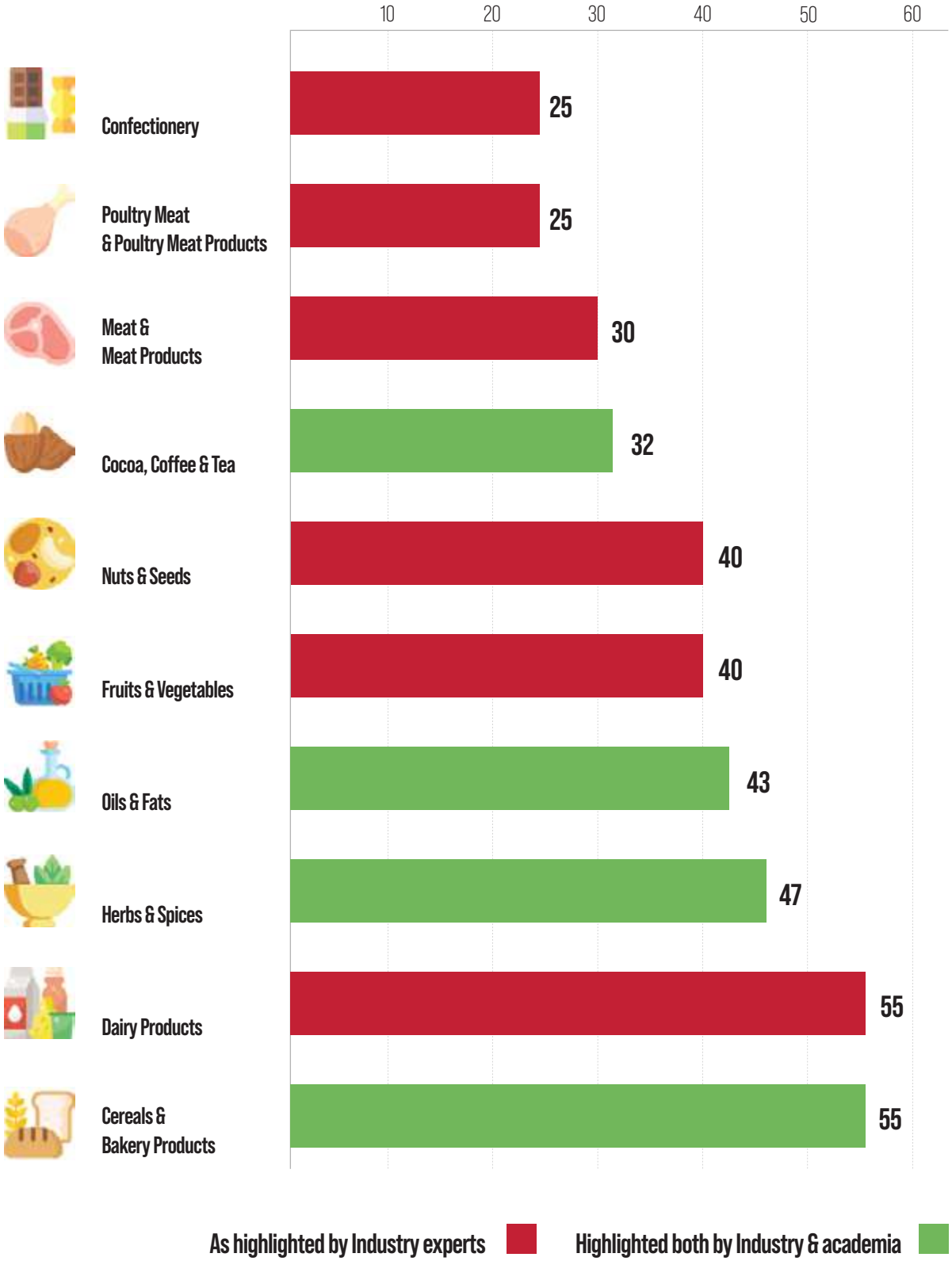
Top-10 areas of concern



FOODAKAI

Risk trends for these Top-10 food categories

FOOD CATEGORY	WHICH RISK WILL INCREASE	EMERGING RISK	GEOGRAPHY WITH HIGH RISK PROFILE
Dairy products	*Listeria Monocytogenes*	*Cronobacter sakazakii*	US, France, Mexico
Cereals & Bakery	*Pesticides*	*Pyrrolizidine alkaloids (pas)*	US, Mexico, India
Herbs & Spices	*Salmonella SPP, Pesticides, ETO*	*Pesticides (carboxin, bifenthrin, tolfenpyrad)*	India, Brazil
Fats & Oils	*Sudan IV, ETO, Glycidyl esters*	*Fraud, Mineral oil*	Ghana, Syria
Cocoa, Coffee & Tea	*Heavy metals, ETO*	*Piperonyl butoxide*	China
Nuts & Seeds	*Mycotoxin, ETO*	*Pesticides (dichlorvos, isoprocarb)*	US, India, China
Fruits & Vegetables	*Liesteria, Salmonella SPP, Aflatoxin*	*Mineral oil*	Turkey, China, US
Meat & Meat Products	*Listeria Monocytogenes, Salmonella SPP, Fraud*	*pyrrolizidine alkaloids (pas)*	US, France
Poultry & Poultry Meat Products	*Salmonella SPP, Foreign bodies*	*Salmonella SPP newport*	Poland
Confectionary	*Salmonella SPP, ETO, Unauthorised colour*	*Fraud*	US, China, Australia

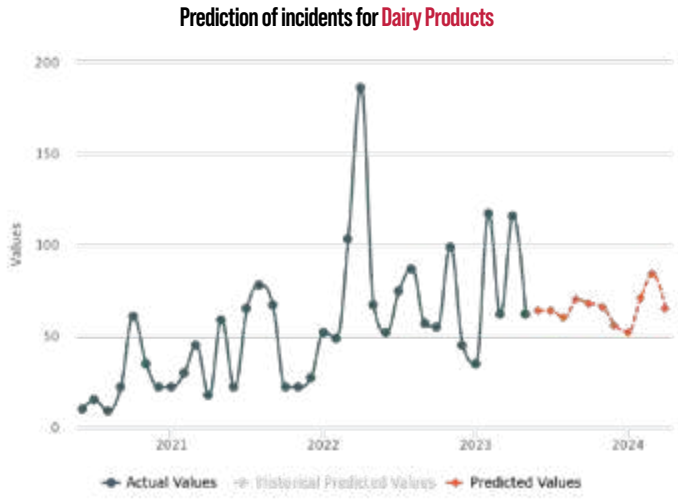
2023

FOOD SAFETY TRENDS & FORECASTS

#1

FORECASTED RISKS FOR DAIRY PRODUCTS

Food safety incidents: trends & forecasts



Confidence: 79.1%

Which is the trend so far

- Increasing trend of incidents during the last 10 years
- The number of incidents has tripled during last 5 years (from 324 in 2017 to 968 in 2022)

Key forecasted trend for the next 12 months

- A decrease in incidents trend by 24% is forecasted
- A peak is expected at the end of 2023

Explanation of deviations/differences of actual vs forecasts

- AI model did not manage to forecast a high peak of incidents in April 2022 which were due to unauthorized dyes used in fried cheese preparation

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
listeria monocytogenes	235	285	21,47%
cronobacter sakazakii	-	-	**NEW**

Existing / known and still trending hazards

A well-known risk like listeria monocytogenes is forecasted to increase in milk & milk products

Emerging hazards that we see in the horizon

- *Cronobacter sakazakii*

Explanation of Emerging hazards

- > 40 products recalled in 2022 due to *cronobacter* in infant formula
- 3 brands linked to the *cronobacter* recalls

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- US, Mexico, France and Italy

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Trend of consuming unpasteurized milk and cheese in US, France, Italy

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"AI dairy products predictions are not surprising. A few recent highly publicized cases linked to baby formula and dairy products are bringing more attention and scrutiny to these product types. With this comes more testing and enhanced FS audits, both of which will inevitably drive such results."

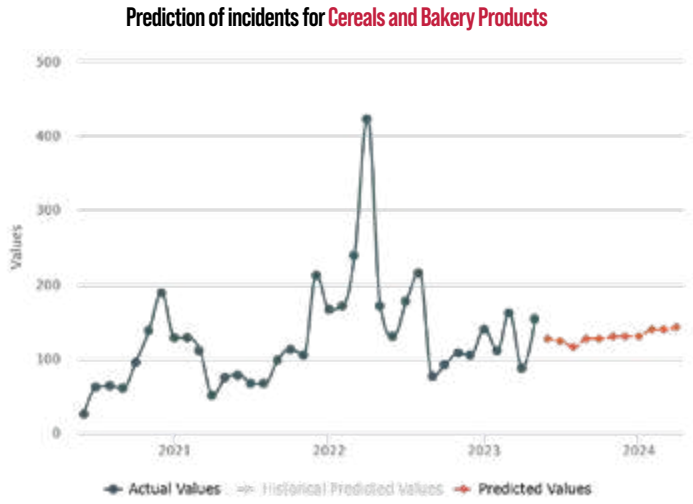
Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

"The number of people consuming unpasteurized milk is still very small but rising. There is an increased risk of bacterial illness associated with this lifestyle choice (as well as some reported health benefits)"

#2

FORECASTED RISKS FOR CEREALS & BAKERY PRODUCTS

Food safety incidents: trends & forecasts



Confidence: 74.9%

Key historical trends (what we see happening so far)

- Incidents have been almost doubled in the last 5 years (1.165 in 2017 to 2.145 in 2022)

Key forecasted trend (for the next months)

- The trend of incidents is expected to decrease by 22% in the next 12 months

Explanation of deviations/differences of actual vs forecasts

- The AI model did not manage to forecast a peak of incidents in Dec 2021, April and August 2022 which were linked to incorrect labelling

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
use of unauthorised artificial colourants / synthetic dyes	597	1102	85%
pesticides	127	216	70%
pyrrolizidine alkaloids (pas)	-	-	**NEW**

Existing / known and still trending hazards

- *Pesticides*
- *Mycotoxin*

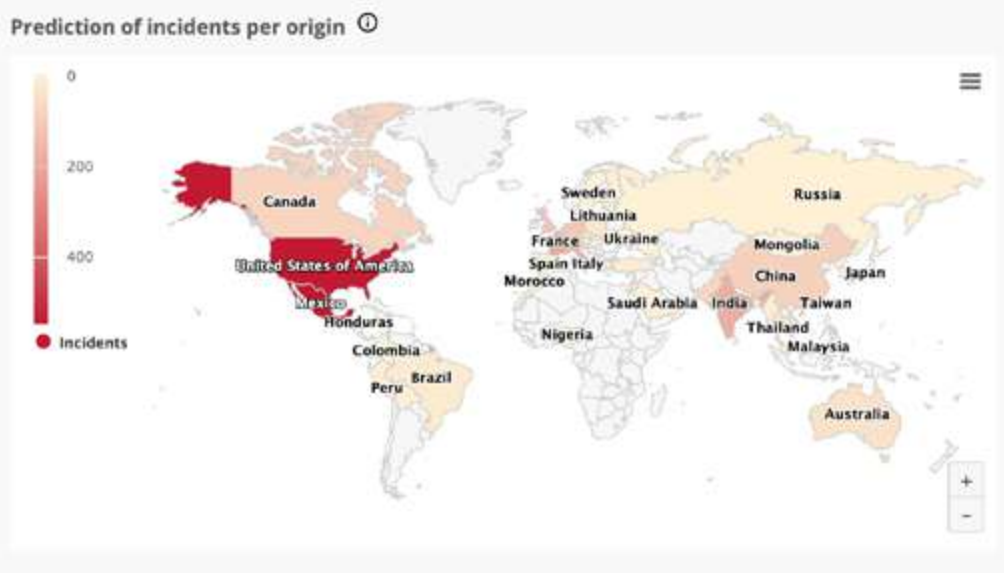
Emerging hazards that we see in the horizon

- *Pyrrolizidine alkaloids (pas)*
- *Aflatoxin B1 in cereals*

Explanation of Emerging hazards

- *Pyrolizidine alkaloids* (pas) in couscous from France *Aflatoxin B1* in corn from US

Heatmap of countries of origin



Countries* that are expected to have significant numbers of incidents

- US, Canada, Mexico, India

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Russian – Ukraine conflict created disruptions in the market that require alternative sourcing regions

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"Some of the forecasted emerging risks in cereals and baked goods is a great new information for me personally. As an industry, I believe chemical hazards continue to catch us off-guard and such predictions are a great insight to consider when managing related raw materials from the indicated countries of origin."

Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

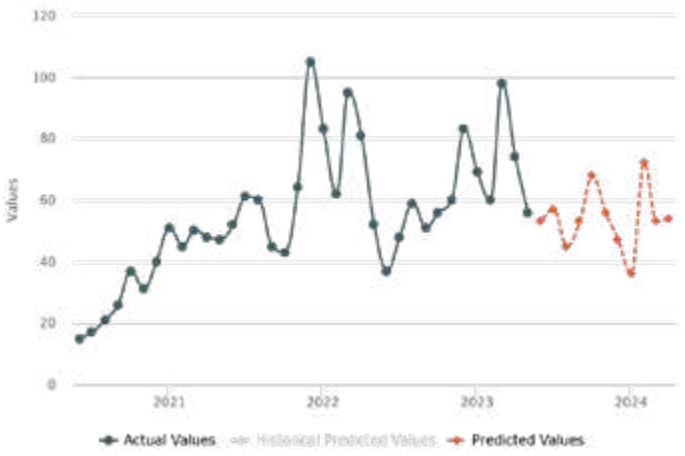
"I believe that quite a number of the predictions are linked to changes in our climate which promote fungal growth, the need for greater use of pesticides and invasive species. Changes in climate will be one of the greatest drivers for increased food safety risks"

#3

FORECASTED RISKS FOR HERBS & SPICES

Food safety incidents: trends & forecasts

Prediction of incidents for Herbs & Spices



Confidence: 81.8%

Key historical trends (what we see happening so far)

- Increasing trend of incidents during the last 10 years
- The number of incidents has tripled during last 5 years (from 324 in 2017 to 968 in 2022)

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will slightly decrease by 11%
- No significant peaks in incidents are expected

Explanation of deviations/differences of actual vs forecasts

- The AI model forecasted well the overall trend in 2022
- The AI model did not manage to forecast a peak of incidents in Dec 2021 and March 2022 which were linked to Salmonella SPP in black pepper and allergen in seasoning respectively

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
pesticides	261	306	17%
Salmonella SPP SPP	215	229	7%
unauthorised ingredient (fraud)	14	146	943%
unauthorised substance ethylene oxide	33	134	306%
aflatoxin	44-	47	7%

Existing / known and still trending hazards

- *Pesticides*
- *Salmonella SPP*
- *Aflatoxin*

Emerging hazards that we see in the horizon

- A decrease in incidents trend by 24% is forecasted
- A peak is expected at the end of 2023

Explanation of Emerging hazards

- *Pesticides** exceeding regulatory limits not previously reported in herbs & spices (*bifenthrin, tolfenpyrad, fenamidone, bromopropylate and others*)
- *Unauthorized substances* used in herbs & spices of high demand

* pesticides - changes MRL, approval of new active substances or substance ban

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- India, Brazil, China, Nigeria

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Increased demand for herbs & spices in the market calls for non-traditional sourcing regions

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"These predictions coincide with the vulnerability assessments and horizon scanning for Herbs and Spices that I came across. It is great to have AI confirmation of this information"

Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

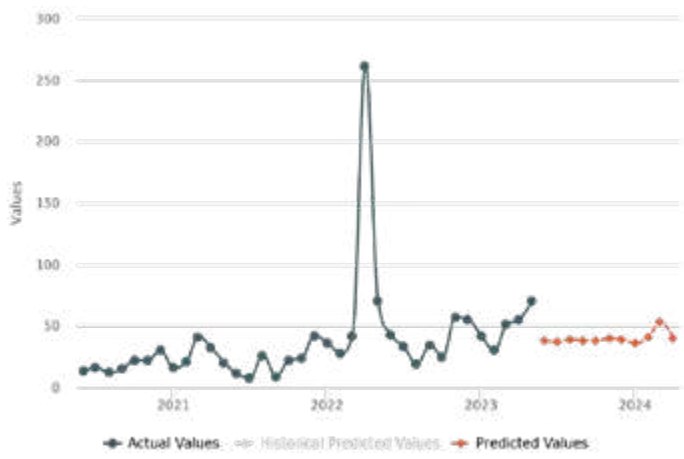
"The scale of fraud in herbs and spices is becoming better understood and the level of testing has increased. More testing means more violations detected and this trend will likely increase due to growing supply–demand issues."

#4

FORECASTED RISKS FOR COCOA, COFFEE & TEA PRODUCTS

Food safety incidents: trends & forecasts

Prediction of incidents for Cocoa, Coffee & Tea Products



Confidence: 81.8%

Key historical trends (what we see happening so far)

- A significant increase of trend during the last 2 years
- Number of incidents in 2022 was doubled compared to 2021

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will decrease by 29%
- No significant peaks in incidents are expected

Explanation of deviations/differences of actual vs forecasts

- The AI model predicted early the increasing trend of incidents (peak in Jan 2022 of historical predicted values)
- The AI model did not manage to forecast the size of the the peak of incidents in April 2022 which was linked to multi-brand recall for Salmonella SPP in chocolate products

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
cadmium	6	12	100%
unauthorised substance ethylene oxide	20	25	25%
perchlorate	-	-	**NEW**
malathion	-	-	**NEW**
chlorfluazuron	-	-	**NEW**
piperonyl butoxide	-	-	**NEW**

Existing / known and still trending hazards

- *ETO* in tea
- *Salmonella SPP* in chocolate products

Emerging hazards that we see in the horizon

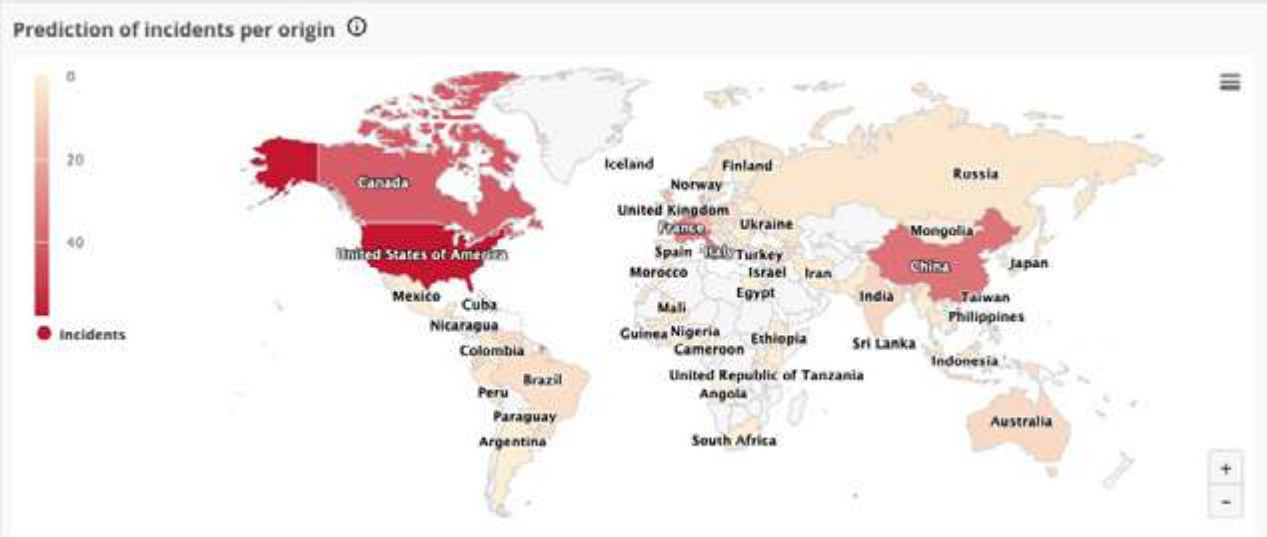
- *Heavy metals* in cocoa and specifically *cadmium*
- *Pesticides (perchlorate, malathion, chlorfluazuron, piperonyl butoxide)*

Explanation of Emerging hazards

- *Pesticides** exceeding regulatory limits not previously reported in cocoa, cocoa products, coffee and tea

* pesticides - changes MRL, approval of new active substances or substance ban

Heatmap of countries of origin



Countries* that are expected to have significant numbers of incidents

- Belgium, US, Canada, Italy

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Belgium, Italy, US & Canada are large producers of finished products that may be recalled
- China is a major supplier for tea worldwide
- Climate change in cocoa growing regions

Expert Reflections

Chris Elliott
Professor of Food Safety and Microbiology
at Queen's University Belfast

"Cocoa and cocoa products are among commodities that are already known to be impacted by changing climate in terms of availability. This data shows food safety is another factor that needs to be addressed in terms of monitoring and sourcing."

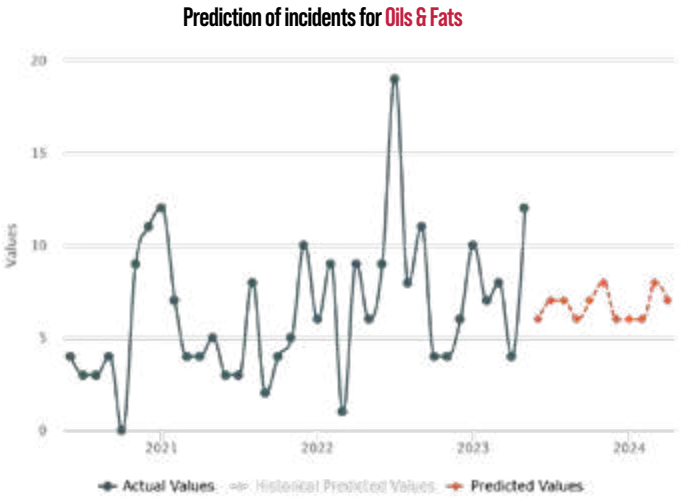
Neil Mashall
Managing Director
at Guv Consulting International LLC

I fully agree that an increase in pesticide levels is a major concern for Beverage producers. It is a likely an indication of pressure for yield increases and the climate effect. I am surprised that Incidents have doubled in 2022 versus 2023. This is a warning for everyone not to be complacent and to closely monitor your supply chains. I believe that we can continue to improve the confidence level of the AI prediction model if we all continue to work together in the non competitive space of food safety and security.

#5

FORECASTED RISKS FOR OILS & FATS

Food safety incidents: trends & forecasts



Confidence: 83%

Key historical trends (what we see happening so far)

- A significant increase of trend during the last 2 years
- Number of incidents in 2022 was doubled compared to 2020

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will decrease by 14%
- No significant peaks in incidents are expected

Explanation of deviations/differences of actual vs forecasts

- The AI model did not forecast the increasing trend of incidents (peak in July 2022) that was linked to unauthorized novel food (C60) in palm oil.

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
fraud	16	27	69%
glycidyl esters	8	13	13%
unauthorised colour Sudan IV	4	7	75%
polycyclic aromatic hydrocarbons	3	7	133%
mineral oil	-	-	NEW

Existing / known and still trending hazards

- *Sudan IV*
- *Polycyclic aromatic hydrocarbons*

Emerging hazards that we see in the horizon

- Industrial contaminants such as ***mineral oil***

Explanation of Emerging hazards

- Disruption in the market due to Ukraine – Russia conflict may increase the risk of ***fraud*** in sunflower oil

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- US, Italy, Ukraine, Syria, Ghana, Czech Republic

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Ukraine – Russia conflict has caused shortages of sunflower oil in the supply chain.
- Attempt to distribute oils in North America which did not have all the legal documents

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"Current geopolitical challenges create a number of ripple effects in the food industry. Specific AI's prediction in this product category are invaluable because it narrows down risks to chase after"

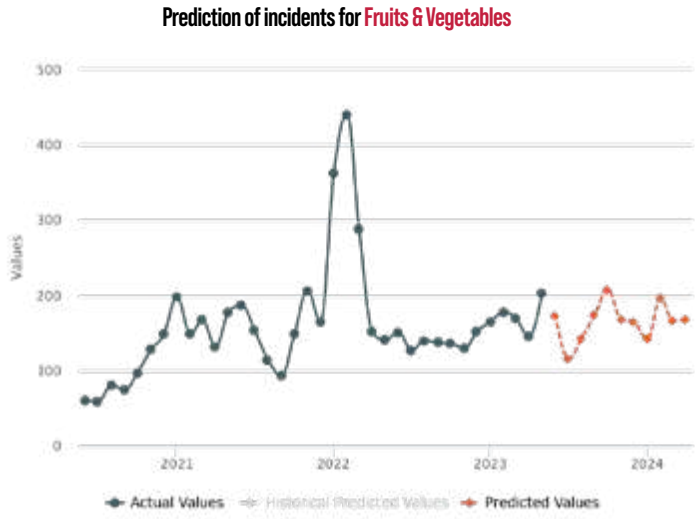
Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

"The potential for serious safety and fraud issues in oils was one of my first predictions following the invasion of Ukraine. The AI data has confirmed this to be the case."

#6

FORECASTED RISKS FOR FRUITS & VEGETABLES

Food safety incidents: trends & forecasts



Confidence: 84.7%

Key historical trends (what we see happening so far)

- A significant increase of trend during the last 5 years
- Number of incidents in 2022 was doubled compared to 2017

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will slightly increase by 4%
- A significant peak of incidents is expected in Oct 2023

Explanation of deviations/differences of actual vs forecasts

- The AI model did not forecast the increasing trend of incidents (peak in Feb 2022) that was linked to a multi-brand recall of listeria in fresh salads (237 different products recalled).

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
pesticides	810	858	6%
listeria monocytogenes	113	241	113%
Salmonella SPP SPP	103	120	17%
aflatoxin	58	76	31%
unauthorised ingredient (fraud)	13	73	462%

EMERGING HAZARDS

Hazards	
benzene-dicarboxamide	NEW
flubendiamine	NEW
iprovalicarb	NEW
triflumuron	NEW

Existing / known and still trending hazards

- *Pesticides*
- *Listeria monocytogenes*
- Use of *unauthorized ingredient* such as *ETO*

Emerging hazards that we see in the horizon

- Several *pesticides* exceeding regulatory limits reported for the first time

Explanation of Emerging hazards

- Climate change created shortages and reduction of fruits & vegetables production
- Climate change has increased the occurrence of toxins and diseases in fruits & vegetables and subsequently the use of plant protection products

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- Turkey, US, China

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Ukraine – Russia conflict has caused shortages in the supply chain of fruits & vegetables
- Alternative regions such as Turkey & China are used for sourcing fruits and vegetables

Expert Reflections

Chris Elliott
Professor of Food Safety and Microbiology
at Queen's University Belfast

"Growing evidence of more impacts of climate change. But to truly understand the reasons for such increase in food safety risks will require a series of root causes analyses to be undertaken."

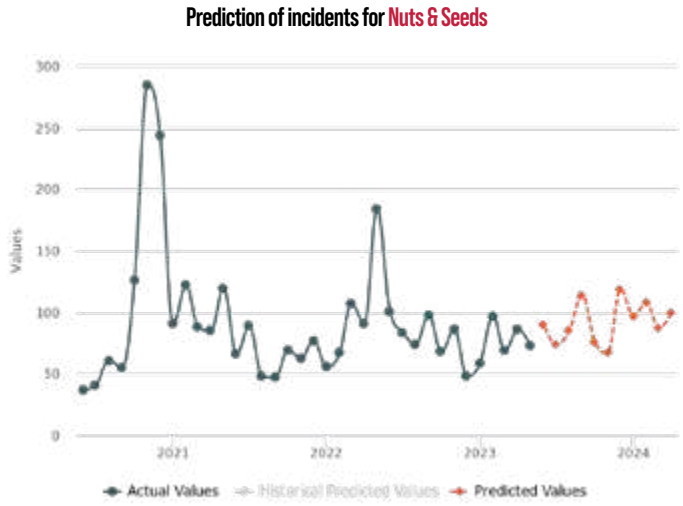
Neil Mashall
Managing Director
at Guv Consulting International LLC

I fully agree that Citrus Greening has decimated the USA Florida citrus industry. I am surprised that we have not seen a bigger impact from the continued conflict in Ukraine. I believe that climate change continues to have a growing impact on the food supply chain.

#7

FORECASTED RISKS FOR NUTS & SEEDS

Food safety incidents: trends & forecasts



Confidence: 95.4%

Key historical trends (what we see happening so far)

- An increasing trend of 50% during the last 5 years
- Number of incidents in 2022 was doubled compared to 2014

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will slightly decrease by 4%
- Two peaks of incidents in September and December 2023 are expected

Explanation of deviations/differences of actual vs forecasts

- The AI model did forecast the increasing trend of incidents (peak in May 2022) but the size of the actual trend was significantly larger.

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
unauthorised substance ethylene oxide	3	242	7967%
mycotoxin	429	433	1%
Pesticides (dichlorvos, isoprocarb)	-	-	**NEW**

Existing/ known and still trending hazards

- *ETO*
- *Mycotoxins*

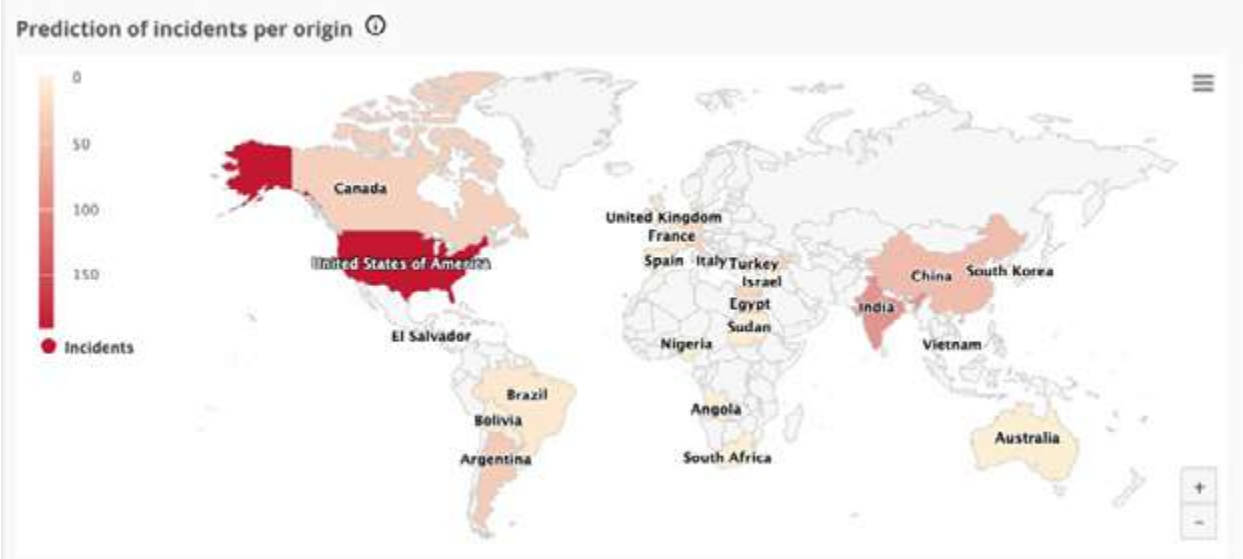
Emerging hazards that we see in the horizon

- Several *pesticides* exceeding regulatory limits reported for the first time

Explanation of Emerging hazards

- Climate change created shortages and reduction of production
- Climate change has increased the occurrence of toxins and diseases in nuts & seeds and subsequently the use of plant protection products

Heatmap of countries of origin



Countries* that are expected to have significant numbers of incidents

- US, India, China, Turkey, Egypt

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Indian producers using *ETO* in seeds due to its disinfectant properties against bacteria, fungi and viruses.
- Climate change in US has increased the occurrence of toxins

Expert Reflections

Chris Elliott
Professor of Food Safety and Microbiology
at Queen's University Belfast

"The nexus between mycotoxins and pesticides is very clear in this data and risk forecast. More challenges to control infestations (again due to climate) and the increased need to apply agrichemicals"

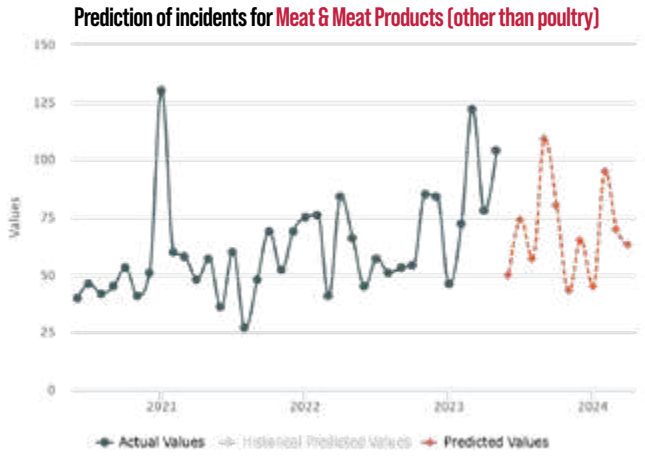
Neil Mashall
Managing Director
at Guv Consulting International LLC

I fully agree that new pesticides will be introduced and adulteration will remain an opportunity for bad actors is the supply chain. I am surprised that ETO remains a potential risk within complex supply chains. I believe that random Pesticide monitoring programs are critical to ensure ingredient compliance.

#8

FORECASTED RISKS FOR MEAT & MEAT PRODUCTS (OTHER THAN POULTRY)

Food safety incidents: trends & forecasts



Confidence: 82.9%

Key historical trends (what we see happening so far)

- A significant increase of trend during the last 2 years
- Number of incidents in 2022 was almost doubled compared to 2020

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will increase by 7%
- A significant peak in incidents is expected in September 2023

Explanation of deviations/differences of actual vs forecasts

- AI models forecasted accurately the trends of incidents and there were no significant variations

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
Salmonella SPP SPP	138	151	9%
listeria monocytogenes	118	139	18%
labelling / misdecription	48	96	100%
inspection issues	5	36	620%
ahigatoxin-producing escherichia coli	18	28	56%

Existing / known and still trending hazards

- *Salmonella SPP*
- *Listeria monocytogenes*
- *E-coli*

Emerging hazards that we see in the horizon

- *Misdescription - masking of origin*

Explanation of Emerging hazards

- Shortages in local supply chain lead to misdescription of meat products

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- US, France, UK

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Shortages in local supply chain lead to misdescription of meat products in areas with high demand for meat and meat products

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"Yet another confirmation of direct negative effects of inflation and political instability across the World"

Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

"I had expected to see a rise in incidents of food safety and fraud in the meat sector due to knock on effects from the pandemic, mainly because of the partial shut down of the food service sector. These are now being manifested in a number of different ways."

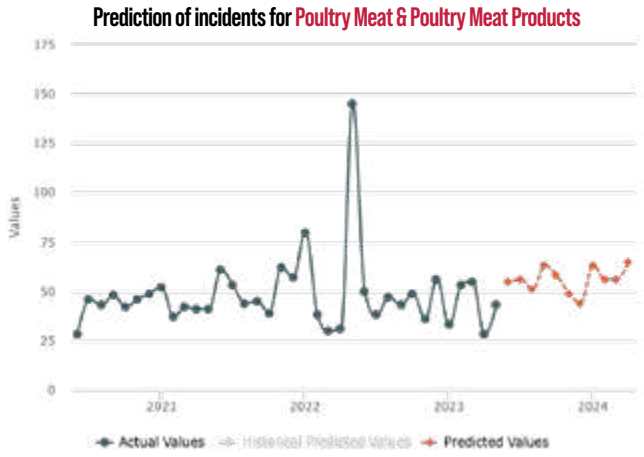
Mike Robach
Chief Executive Officer,
The Robach Group

"I am not surprised to see that a number of hazards are predicted to increase due to ongoing supply chain issues, inconsistent regulation, and the increased demand for animal protein."

#9

FORECASTED RISKS FOR POULTRY MEAT & POULTRY MEAT PRODUCTS

Food safety incidents: trends & forecasts



Confidence: 95%

Key historical trends (what we see happening so far)

- An increasing trend of incidents during the last 5 years
- Number of incidents in 2022 was doubled compared to 2018

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will increase by 10%
- A significant peak in incidents is expected in Sep 2023

Explanation of deviations/differences of actual vs forecasts

- The AI model did forecast the increasing trend of incidents (peak in May 2022) but the size of the actual trend was larger

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
Salmonella SPP	437	449	3%
Salmonella SPP typhimurium	23	28	22%
Foreign bodies	16	22	38%
Salmonella SPP bovismorbificans	-	-	**NEW**
Salmonella SPP mbandaka-Salmonella SPP	-	-	**NEW**

Existing / known and still trending hazards

- *Salmonella SPP*
- *Foreign bodies*

Emerging hazards that we see in the horizon

- Serotypes of *Salmonella SPP* not reported before*

Explanation of Emerging hazards

- Extensive use or/and the misuse of antibiotics can be a factor in the development and spread of antimicrobial resistance in bacteria such as *S. Mbandaka* and *S. Bovismorbificans*.

* Advanced tools for pathogens detection (omics technologies, biosensors etc)

Heatmap of countries of origin

Countries* that are expected to have significant numbers of incidents

- Poland, France, US, UK

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Poland is the main producer of poultry meat in Europe during the last years.
- Various conditions of poultry farming such as ineffective biosecurity, a high stocking density, or the increasing threat of viral diseases causing immunosuppression, significantly contributes to the increase in the use of antibiotics and indirectly to the overall increased antibiotic resistance.

Expert Reflections

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"Predictions are fully aligned with available food safety publications and recall information"

Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

"I believe there is also the 'pandemic' effect is the issues identified in poultry products. Reduced physical inspections, cost pressures on production and some markets badly effected"

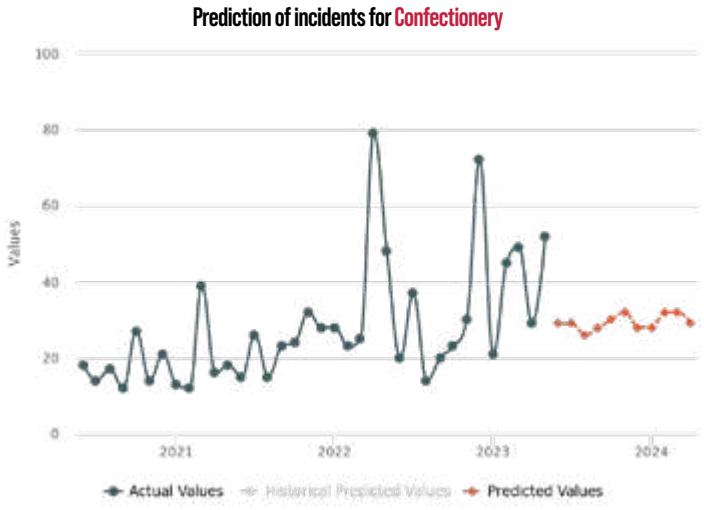
Mike Robach
Chief Executive Officer,
The Robach Group

"With global poultry demand increasing and new companies and countries entering the marketplace it is likely that risk will continue to grow. Not only the risk of enteric pathogens, but also the risk associated with inadequate bio security leading to the emergence of new strains of avian influenza and other zoonotic hazards."

#10

FORECASTED RISKS FOR CONFECTIONARY

Food safety incidents: trends & forecasts



Confidence: 77.9%

Key historical trends (what we see happening so far)

- A significant increase of trend during the last 2 years
- Number of incidents in 2022 was three times larger compared to 2020 (from 175 to 512)

Key forecasted trend (for the next months)

- The overall 12-month trend of incidents will decrease by 26%
- A peak in incidents is expected in Nov 2023

Explanation of deviations/differences of actual vs forecasts

- The AI model did not forecast the increasing trend of incidents (peak in April 2022) that was linked to a multi-brand *Salmonella SPP* recall in Israel

Emerging risks & hazards

HAZARDS LIKELY TO INCREASE

Hazard	Past 12 months	Next 12 months	Tendency
Salmonella SPP	187	228	22%
unauthorised substance ethylene oxide	8	41	413%
unauthorised colour	10	15	50%
Fraud	-	-	**NEW**

Existing/known and still trending hazards

- *Salmonella SPP*
- *Use of unauthorized colours*

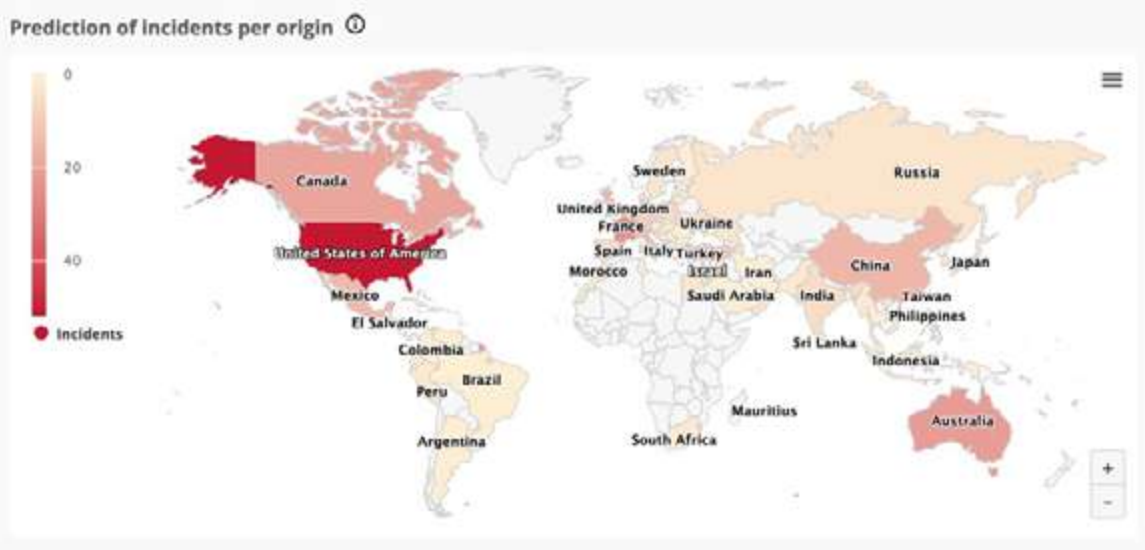
Emerginghazards that we see in the horizon

- *ETO*

Explanation of Emerging hazards

- Food additives contaminated with *ETO* are used as ingredient in many confectionary products

Heatmap of countries of origin



Countries* that are expected to have significant numbers of incidents

- US, China, Australia

* origin of material, ingredient or finished product recalled

Why these increased incident trends are being reported

- Several allergen issues reported in US
- Several issues linked to non-compliance to standards for candies from China

Expert Reflections

Chris Elliott
Professor of Food Safety and Microbiology at Queen's University Belfast

"The ETO impact on confectionary was something that I had no previous information about. An important case study for me to show how AI can augment my knowledge of food safety risks."

OVERALL REFLECTIONS

Reflection on the 2023 trends and predictions

Chris Elliott
Professor of Food Safety and Microbiology
at Queen's University Belfast

"The added dimension of predictive analysis to risk assessments and thus risk management plans will be of huge importance to food companies. Better targeting of finite resources to protect their business and their customers will result."

Agree

- ***The analysis of data*** *(often complex) reveals many things that are not obvious*
- *I am observing the power of AI and PA in many areas of science and* ***food safety has multiple data sources to make them robust***
- ***The case studies*** *presented are very convincing in terms of their ability to predict serious issues*

Not Sure

- *For the many types of food commodities, ingredients* ***how many 'red lights'*** *will we get and will this overload the resources available to deal with them?*

Reflection about the potential of AI

"There is a growing evidence base that AI can accurately predict future food safety risks. Knowing the specific food ingredients and commodities that are potential 'red flags' and understanding higher risk sourcing regions means that an 'actionable intelligence' approach can be followed. "

Reflection on the 2023 trends and predictions

Neil Mashall
Managing Director
at Guv Consulting International LLC

"There is a growing evidence base that AI can accurately predict future food safety risks. Knowing the specific food ingredients and commodities that are potential 'red flags' and understanding higher risk sourcing regions means that an 'actionable intelligence' approach can be followed. "

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

"I know first and how easy it is to get lost in the sea of emerging risks. This is why I seek information that can help me navigate my teams' energy and resources spent chasing risks. For me personally, chemical hazards continue to be an area of interest because of the attention they get from the consumer and regulatory authorities. Pinpointing exact chemicals of concern in specific product categories makes it easier to define supplier management strategies and enhancements to internal controls."

Expert Reflections

John Carter
Area Europe
Quality Director at Ferrero

Agree

"I fully agree that an effective monitoring of global trends can be a useful predictor of certain types of food safety issues"

Not Sure

"I am surprised that Models are not yet able to predict the food safety effects of global macro-trends; climate issues, international conflicts, supply chain disruption. These could particularly influence food fraud, for example"

Surprises

"I believe that ....AI models have the capability to learn... constructive criticism today can lead to true value tomorrow "

Reflection on the 2023 trends and predictions

Richard Stadler
Head, Nestlé Institute
of Food Safety & Analytical
Sciences at Nestlé Research

Agree

We simply cannot exploit the huge amount of data *and information out there without AI, i.e. interconnect data and identify signals and trends that may impact our business*

Not Sure

The source of the data *and its "reliability" will in many cases need to be verified, so an "expert" review or decision remains pivotal (at least at this point in time)*

Surprises

Many "issues" previously identified tend to be forgotten *and surprising how frequently certain topics re-emerge—essentially testing our measures to mitigate or manage them*

Most important I see in this year's trends

Mike Robach
Chief Executive Officer,
The Robach Group

The most important trends I see out of this forecast include Cronobacter sakazakii in milk and milk products, especially powdered infant formula, the recognition of mycotoxin issues in the global grain supply, the increasing presence of pesticides in grains, oilseeds and cocoa, substitution fraud in edible oils and enteric pathogens in fruits and produce.

John Carter
Area Europe
Quality Director at Ferrero

I believe the principle is very valuable, but the models need to learn. We need to make sure that the predictions are challenged regularly.

Reflection about the potential of AI

Vera Petrova Dickinson
CEO, Innova-Q
Global FSQ Leader

What would it take for me to trust these predictions?

- ***More real-life examples*** *to help us understand critical data inputs needed to drive accuracy of prediction and to demonstrate evolution of machine learning*
- ***Education:*** *Data and AI literacy is a critical foundation needed in our FSQ community*

In which decisions would I take them into consideration?

- ***Long-term strategic decisions*** *on FSQ investments (ie lab equipment, capability needs on the team, business relationship with suppliers, etc)*
- ***Short-term imminent decisions:*** *updates to FS plans, updates to material specs, supplier management verification plans*

Richard Stadler
Head, Nestlé Institute of Food Safety & Analytical Sciences at Nestlé Research

What would it take for me to trust these predictions?

- ***The quality of the data used in the predictions*** *(not all are reliable) and the sources*
- ***Verification****—react fast to early indicators*

In which decisions would I take them into consideration?

- ***In raw material risk classification****—e.g. how they are considered in (i) HACCP studies, (ii) Raw Material Purchasing Specifications, (iii) Contaminant Surveillance plans*
- ***Strategic research program*** *in (digital) food safety*

Reflection about the potential of AI

Neil Mashall
Managing Director
at Guv Consulting International LLC

What would it take for me to trust these predictions?

Now we are getting upwards of 95% confidence levels, more people will begin to trust the technology, and that will help to refine and hone the data further

In which decisions would I take them into consideration?

For predicting potential issues, combined with industry subject matter expert (SME) input, to verify the technology

Mike Robach
Chief Executive Officer,
The Robach Group

With AI, we have the ability to consolidate data from multiple sources and mine this data for trends that can alert us to the potential of an emerging risk. This can better prepare the industry to address these emerging issues earlier and prevent a recall or adverse public health consequences.

Reflection about the potential of AI

John Carter
Area Europe
Quality Director at Ferrero

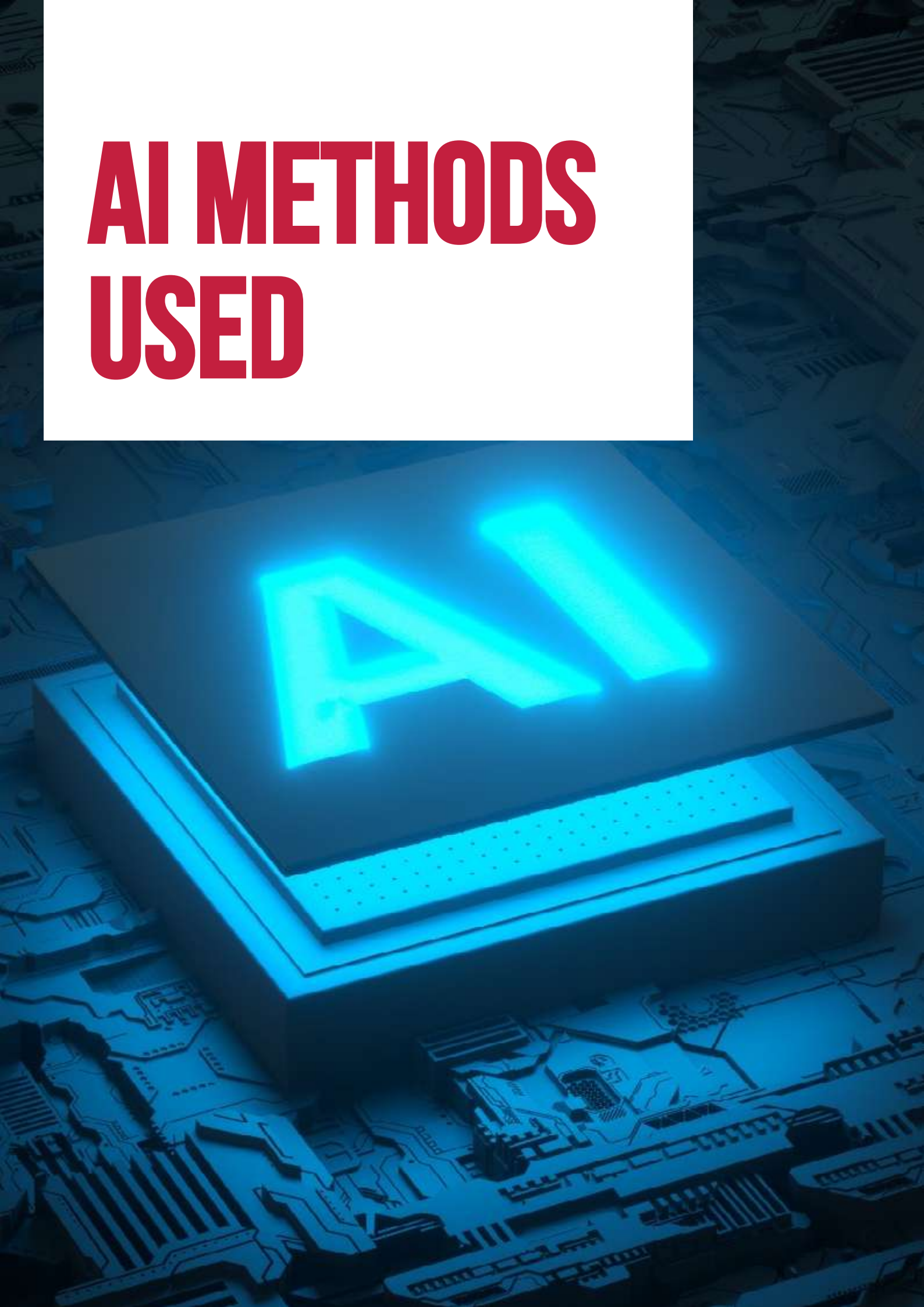
What would it take for me to trust these predictions?

- *demonstrable correctness! Some 'A-ha' stories.*
- *deep insight on key trends (including global macro-trends)*

In which decisions would I take them into consideration?

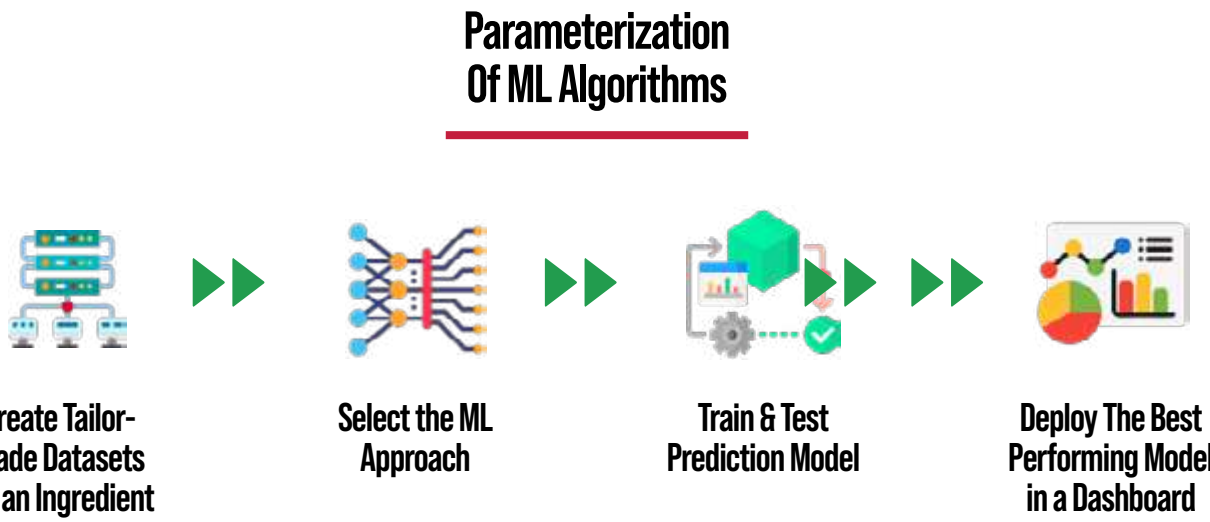
- *supply side disruptions, triggered by or linked to e.g. RASFF notifications, explaining the 'why'*

AI METHODS USED



Methodology to build AI models

How did we build a model and design a dashboard to answer such questions?



Polychronou, I., Katsivelis, P., Papakonstantinou, M., Stoitsis, G., & Manouselis, N. (2020, February). **Machine Learning Algorithms for Food Intelligence: Towards a Method for More Accurate Predictions**. In International Symposium on Environmental Software Systems (pp. 165-172). Springer, Cham.

The AI powered risk forecasts have been generated using a methodology which is tailor made to each ingredient.

The first step of the methodology is to prepare the datasets that is specific for each ingredient/ material and is not generic.

The second step is to select the best ML approach which fits to the question that we need to answer.

Then it is very important to follow an iterative process of parameterizing, training and testing the performance of the model for the different values of parameters.

The goal of this iterative process of parametrization, training and testing is to deploy the best performing model and deliver it through a live forecasting dashboard.

The platform: FOODAKAI's Prediction Module

Dashboards that provide insights about **the emerging food safety trends** in the global landscape that we should keep an eye on

Food Safety Incident Trends & Forecasting: the use case that we have been working on since 2021

Addresses the question: "Which are the emerging food safety trends in the global landscape that we should keep an eye to?"

For us is a priority to provide all the information that the experts need to understand this technology and to help in adopting AI in risk prevention.

This is why during the last 3 years we are working on delivering food safety trends and forecasting in an easy and simple way. The main goal is to answer the question "Which are the emerging food safety trends in the global landscape that we need to keep an eye to"

What we can do with such AI forecasts

01 

Communicate the risk to organization

02 

Proactively **adjust supplier practices**

03 

Proactively **adjust our testing plan**

04 

Proactively **adjust our audit plan**

05 

Change suppliers

Prediction successes

01 

The increasing trend of ETO in sesame seeds and Ain herbs and spices was forecasted in September 2020

02 

Salmonella SPP increasing trend for chocolate products forecasted in Oct 2021 and the incidents started on Feb 2022

03 

Increasing trend for Heavy metals in cocoa highlighted in May 2022 and in Dec 2022 we had the first consumer reports and lawsuits to companies

FOODAKAI

EFRA
EXTREME FOOD RISK ANALYTICS

Let's Ensure Safer Food For All

Contact Us: www.efraproject.eu | www.agroknow.com

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