Holistic and resilience approach to food safety management

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Let me introduce my selves

- Principal scientist Wageningen Food Safety Research
- Professor Food Safety Economics, Wageningen University
- Content wise working on food safety in the supply chain, predictive modelling, early warning

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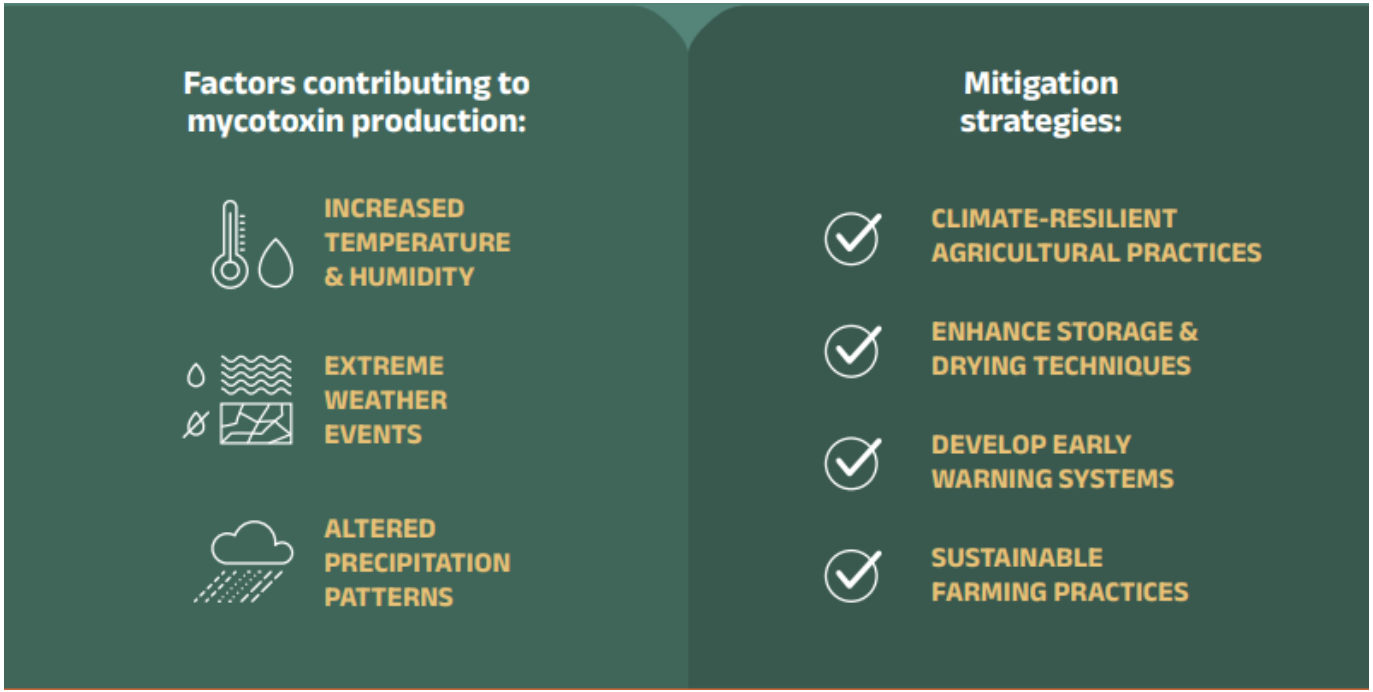
Changes in our environment…

Example: mycotoxins



Drivers of change

Science & Technology
Innovation
Digitalisation

Geo-politics
Globalisation
International trade

Socio-economics
Consumer preference
Income distribution

Demographics
Population growth
Urbanisation

Environment
Climate change
Natural resources

Socio-cultural
Social values
Food choices

Policy
Food security
Regulation

Cloud computing

AI & Big Data ⟷ **AI & Big Data** ⟷ **AI & Big Data**

Outcomes

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

System approach | System approach | System approach

Food safety emerging risks system

Food security

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Food safety management

- Known Food safety hazards
- Management systems like HACCP
- Call for pro-active, anticipatory approach

FoodsafeR and HOLiFOOD

- European projects, funded in same call
- Run 2022-2026
- Focus on emerging risk identification and pro-active & holistic food safety management

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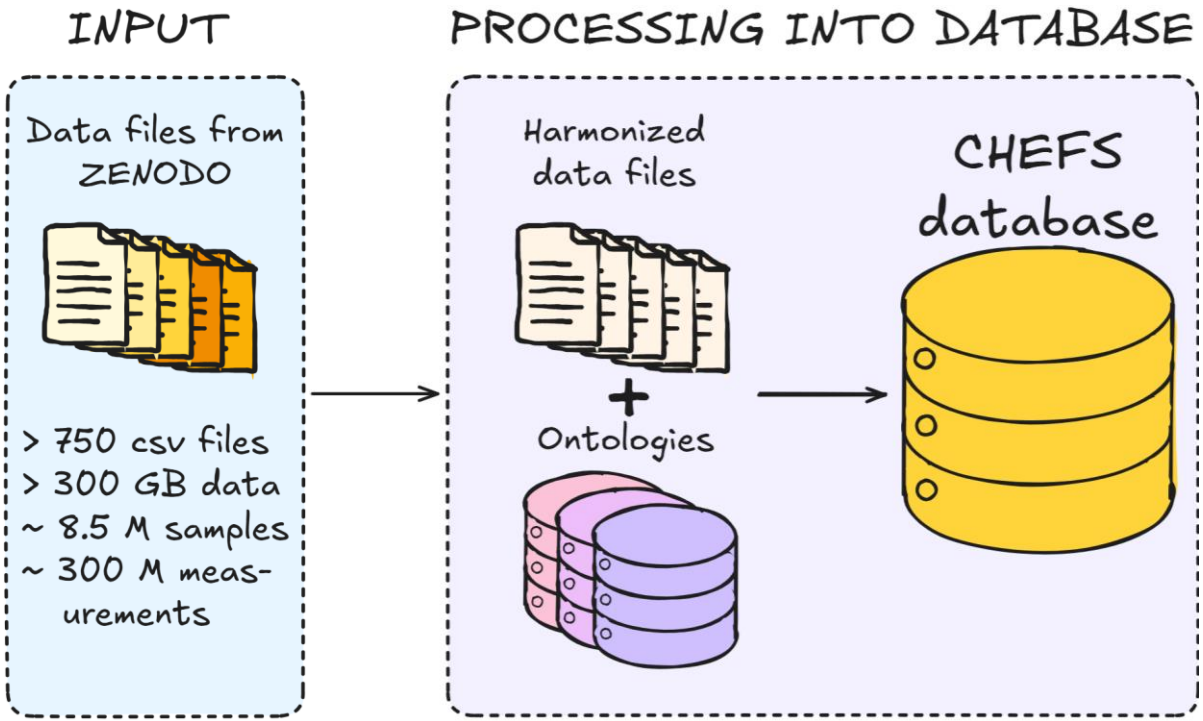
Approaches for early identification

- Predictive models for (emerging) known hazards
- Pick up trends from media, scientific literature etc
- Signalling trends, via contacts and networks
- ….

CompreHensive European Food Safety (CHEFS) database



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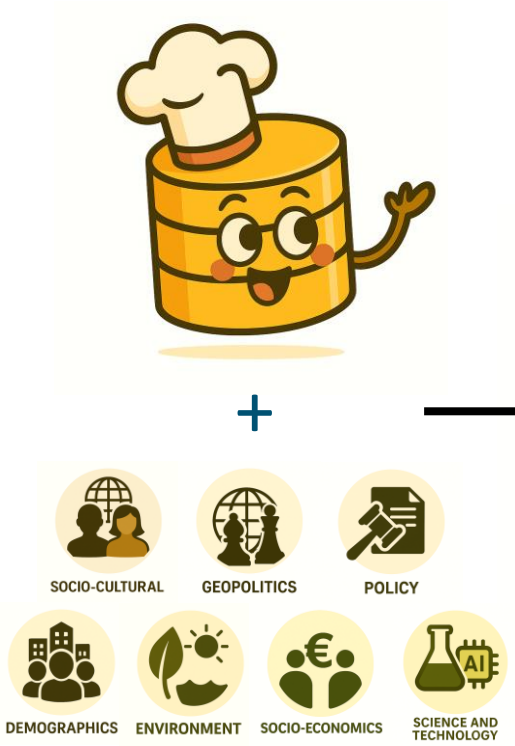
Kızılılsoley et al. *Submitted*

Prediction models



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Mycotoxins in grains

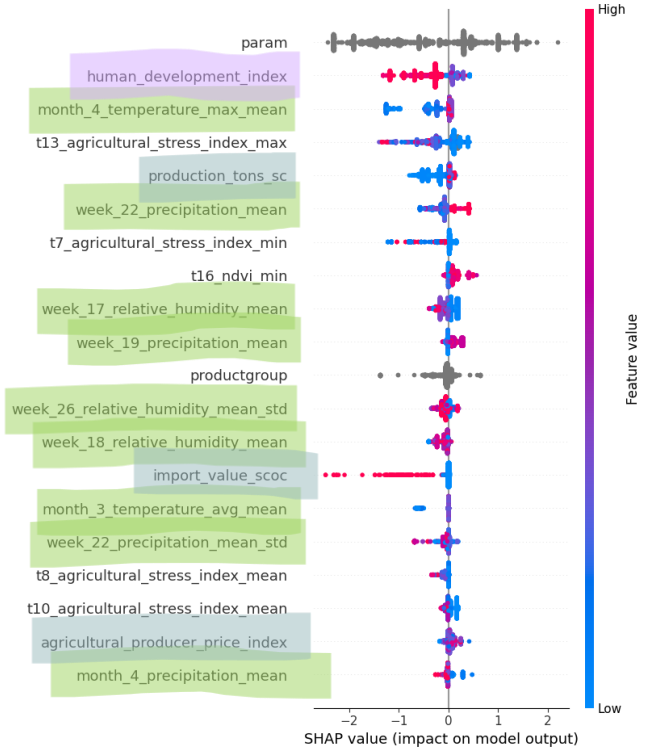
Explainable AI

- Multiple cereal grains
- Multiple mycotoxins
- Multiple AI methods

AI performance 80 %

(AUC)

XGBoost+SHAP



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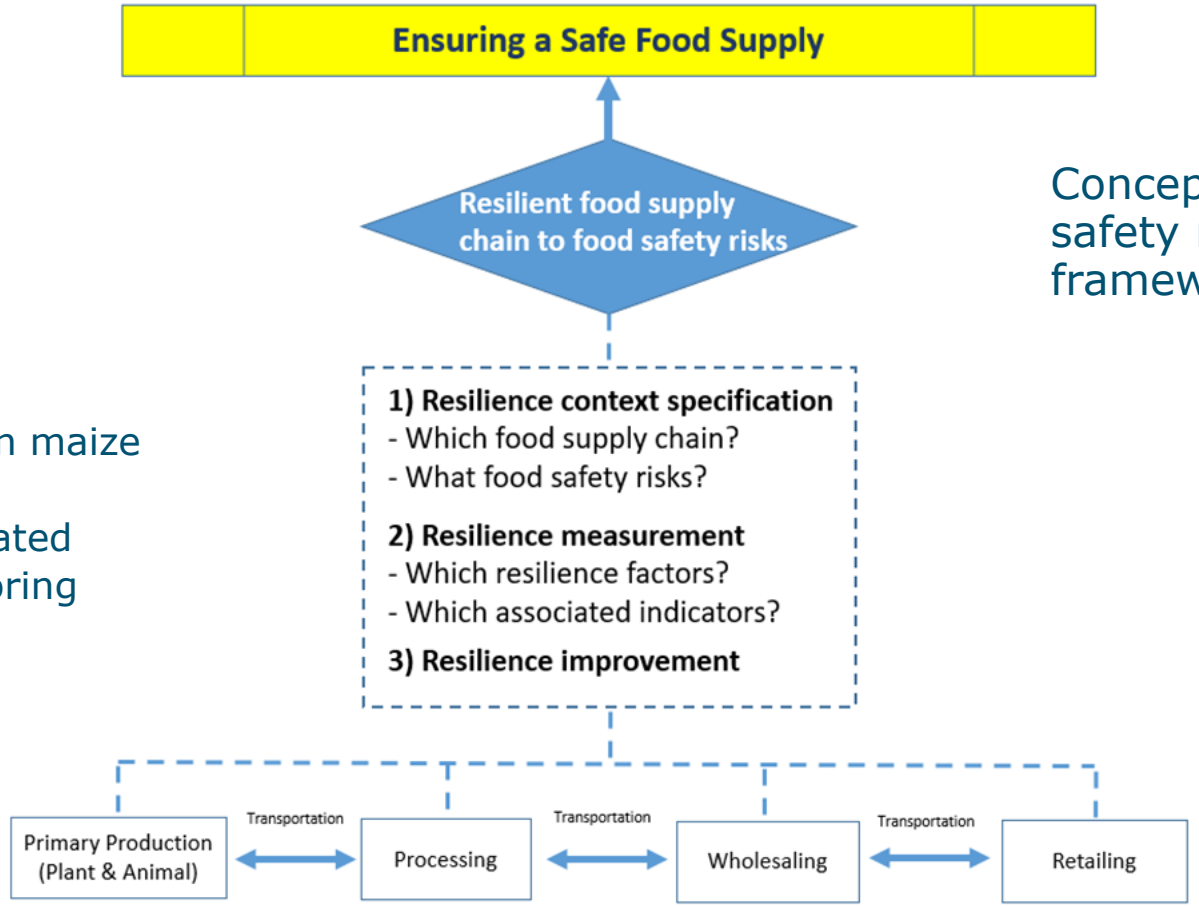
Korporaal et al. in preparation; van der Velden et al, MedIA, 2022

Resilience of supply chains

- Given the drivers, deal with the presence of hazards
- Resilience concept

"**Recovery capacity** of the food **supply chain** to unwanted disruptions related to the presence of **food safety hazards** to allow the delivery of safe food to consumers over a **reasonable lead time**"

- Resilience thinking VS Risk management thinking
    - Inevitable risks (endemic, emerging risks)
    - Pro-active



Conceptual food safety resilience framework

e.g.

1. Mycotoxins in maize chain
2. % contaminated
3. Extra monitoring

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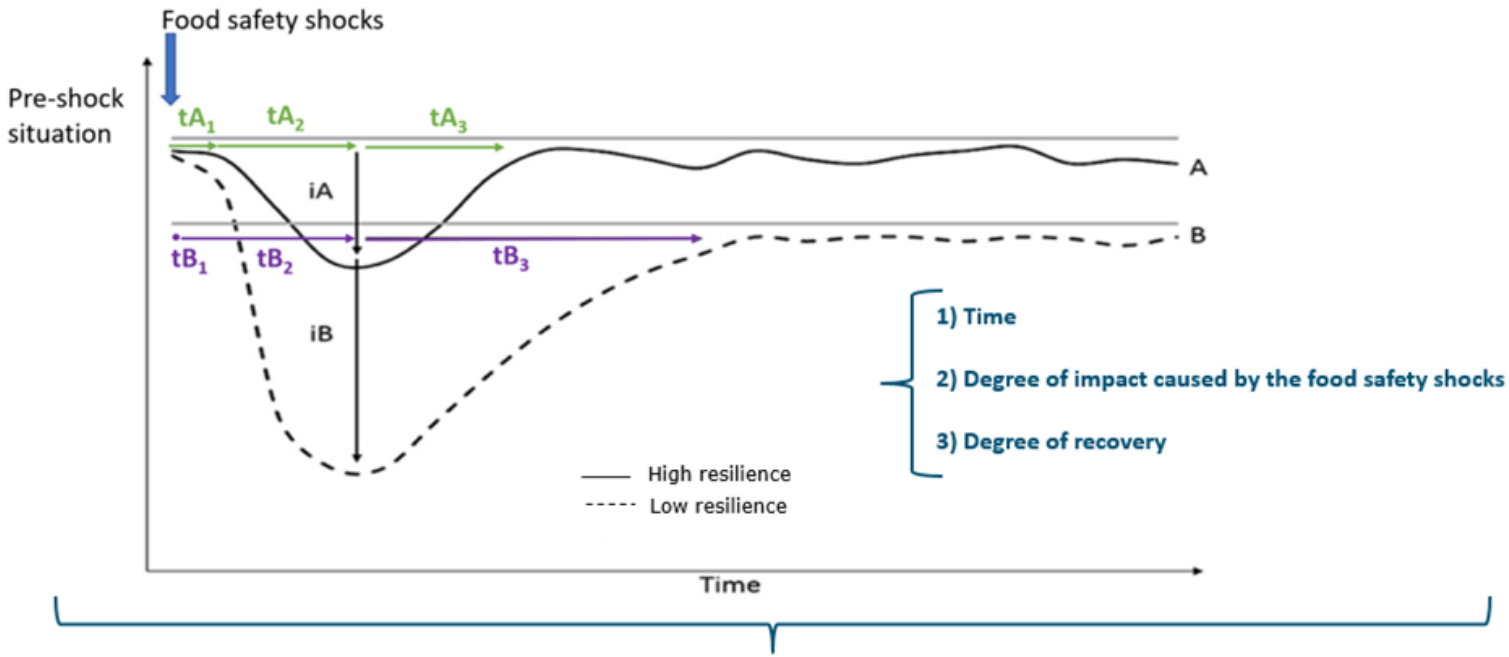
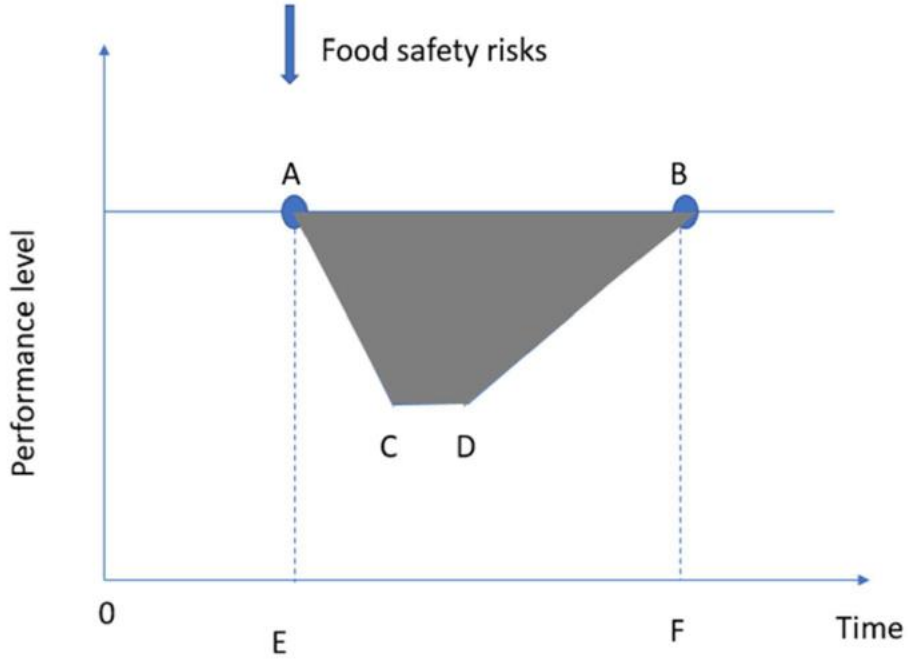
(Mu, van Asselt, van Wagenberg, van der Fels-Klerx, 2020)

Resilience measurement



Resilience model quantification



Resilience approach

Quantified for pork supply chain for various hazards:

- Salmonella
- *Dioxins*
- Hepatitis E
- Toxoplasma gondii

Case: Dioxins in pork supply chain

Aim: Evaluate monitoring strategies for Dioxins in pork supply chain

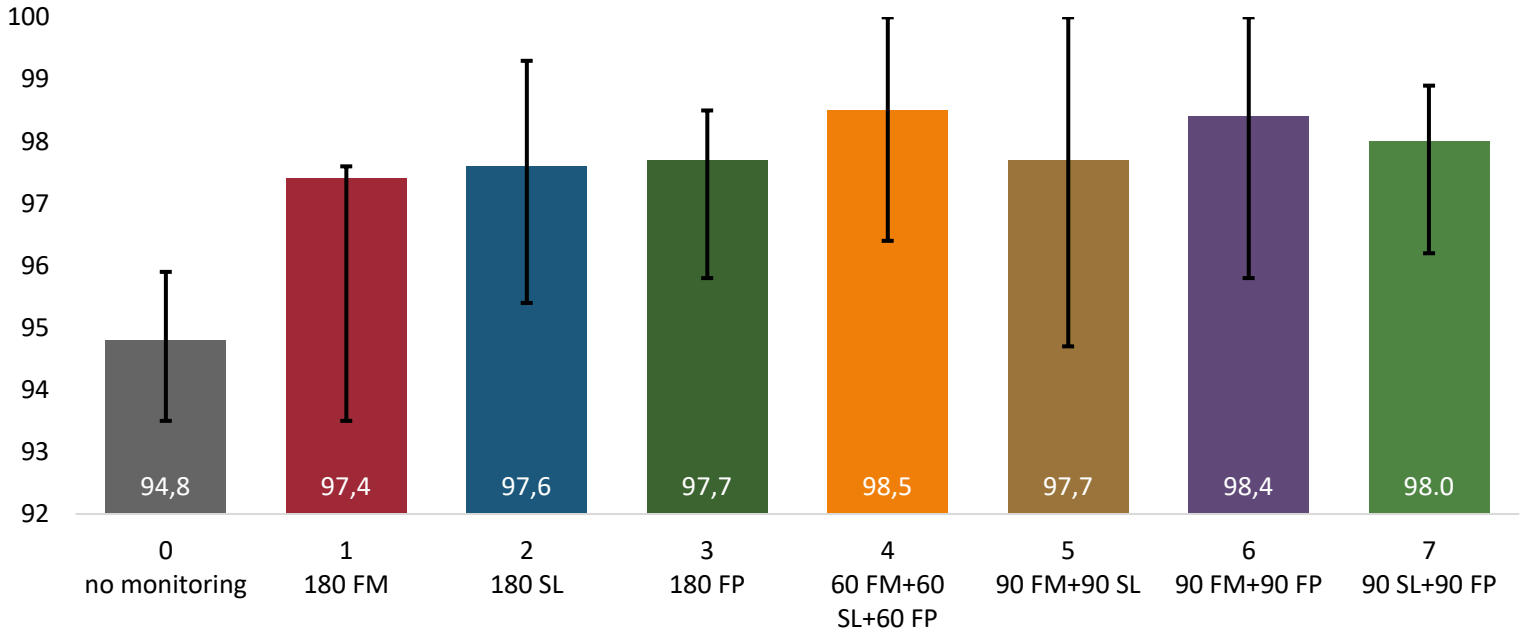
Goal: all final products have concentration below ML

7 monitoring options: total 180 samples

MC model, for Costs and effectiveness

Chain stages:

Resilience for different monitoring options



7 monitoring options (180 samples, 3 control points, fixed budget)

FM = Feed mills, SL = Slaughterhouses, FP = Fat melting facilities

Average and SD 1000 MC simulations

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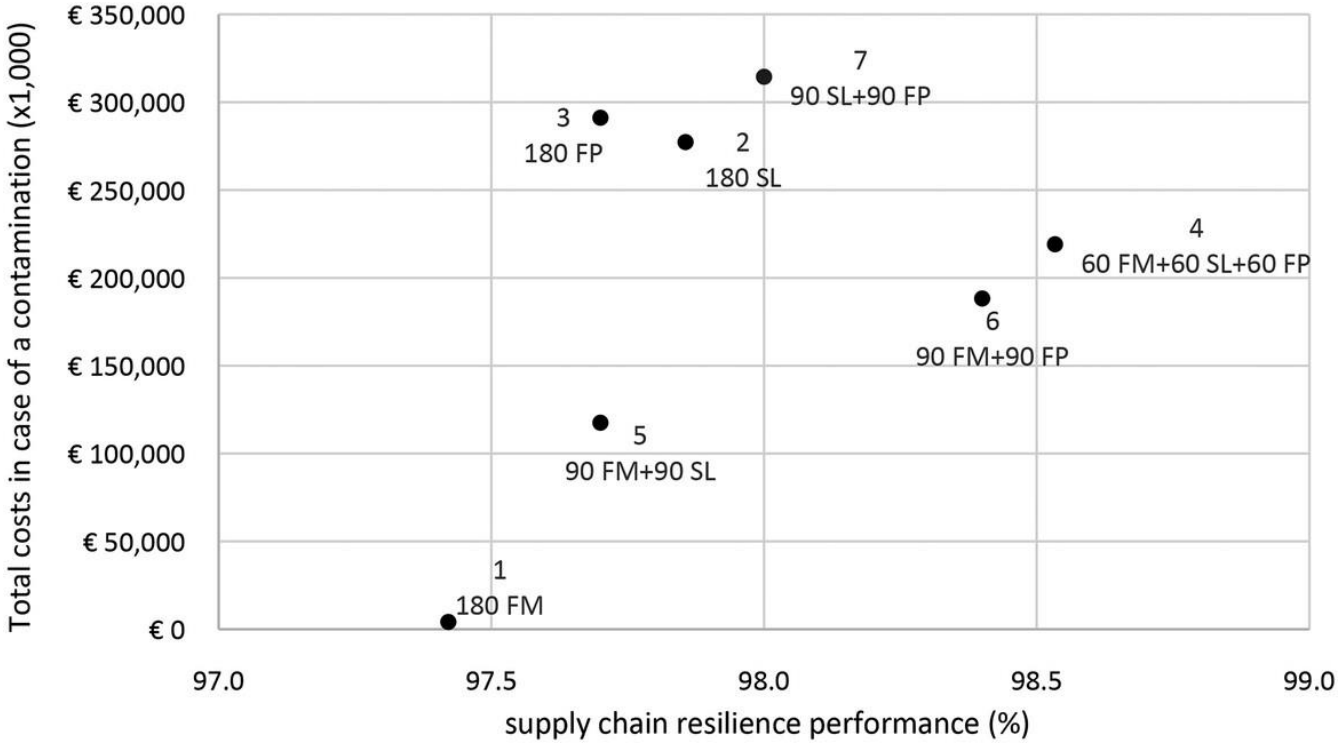
Cost and effectiveness



Costs and effectiveness of the different monitoring options (costs include monitoring and recall etc)

Take home messages

- Holistic approach for emerging food safety risks
- Resilience thinking

- Improves capacity of safe food supply

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Thank you for your attention !

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