FACULTY OF BIOSCIENCE ENGINEERING

DEPARTMENT OF FOOD TECHNOLOGY, SAFETY AND HEALTH
RESEARCH GROUP FOOD MICROBIOLOGY AND FOOD PRESERVATION

RESILIENCE THINKING IN FOOD SAFETY MANAGEMENT SYSTEMS AT FOOD BUSINESS LEVEL

In anticipation to microbiological food safety challenges

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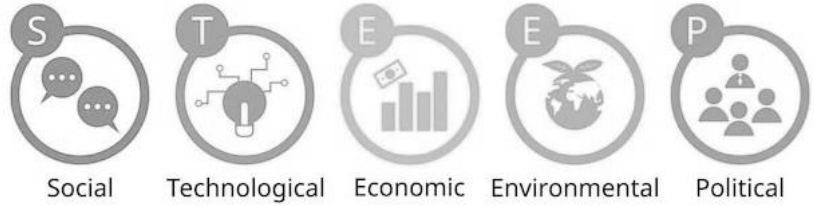
DRIVERS OF CHANGE



Social Drivers	Consumer behaviour
	Demographic development
	Health and wellbeing
Technological Drivers	Technologies in food production
	Technologies in food processing
Economic Drivers	Distribution
Environmental Drivers	Environmental contamination
	Management of natural resources
	Climate change
Political Drivers	Legislation, policies and governance
	Geopolitical instability

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IMPACT ON FBOs AND FSMS : INNOVATION VS. FOOD SAFETY SHOCK

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Influence of the external business environment on food safety management systems: a case study of microbiological food safety challenges

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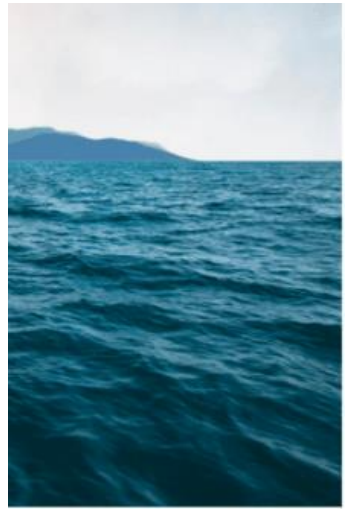
INNOVATION VS. FOOD SAFETY SHOCK

Innovation → intentional and long-term strategies

Food Safety Shocks = unwanted disruptions related to the increasing presence or emergence of food safety hazards (Mu et al., 2021).

→ Unwanted, unanticipated, low-likelihood, high-impact events



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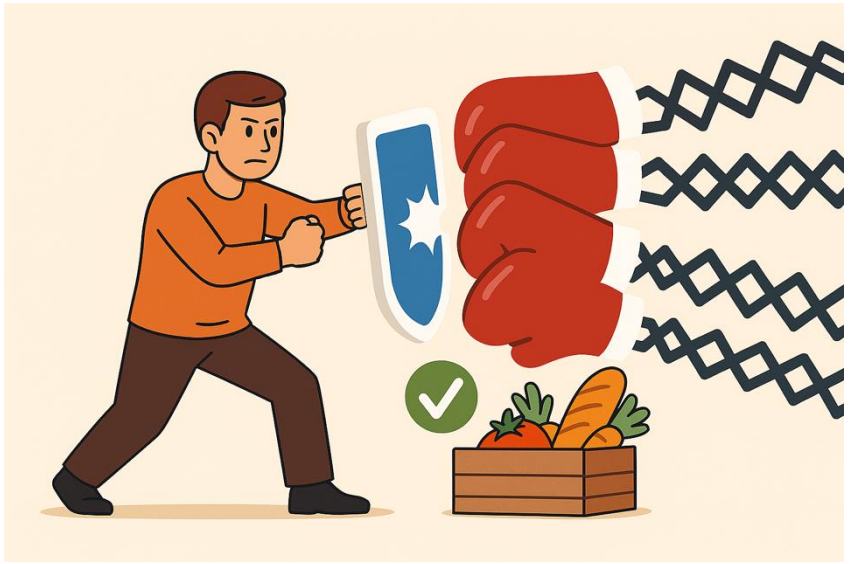
RESILIENCE – RESILIENT RESPONSE

- **Resilience =** the capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate an accessible food to all, in the face of various and even unforeseen disturbances (Tendall et al., 2015).

- **Resilience** = the recovery and adaptation capacity of the food supply chain to food safety shocks to allow the delivery of safe food over a reasonable lead time (Mu et al., 2021).

- **Resilience** = the ability of the FSMS to survive supply chain shocks or incidents which are associated with increased food safety risks (Manning et al., 2023).



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RESILIENCE – RESILIENT RESPONSE

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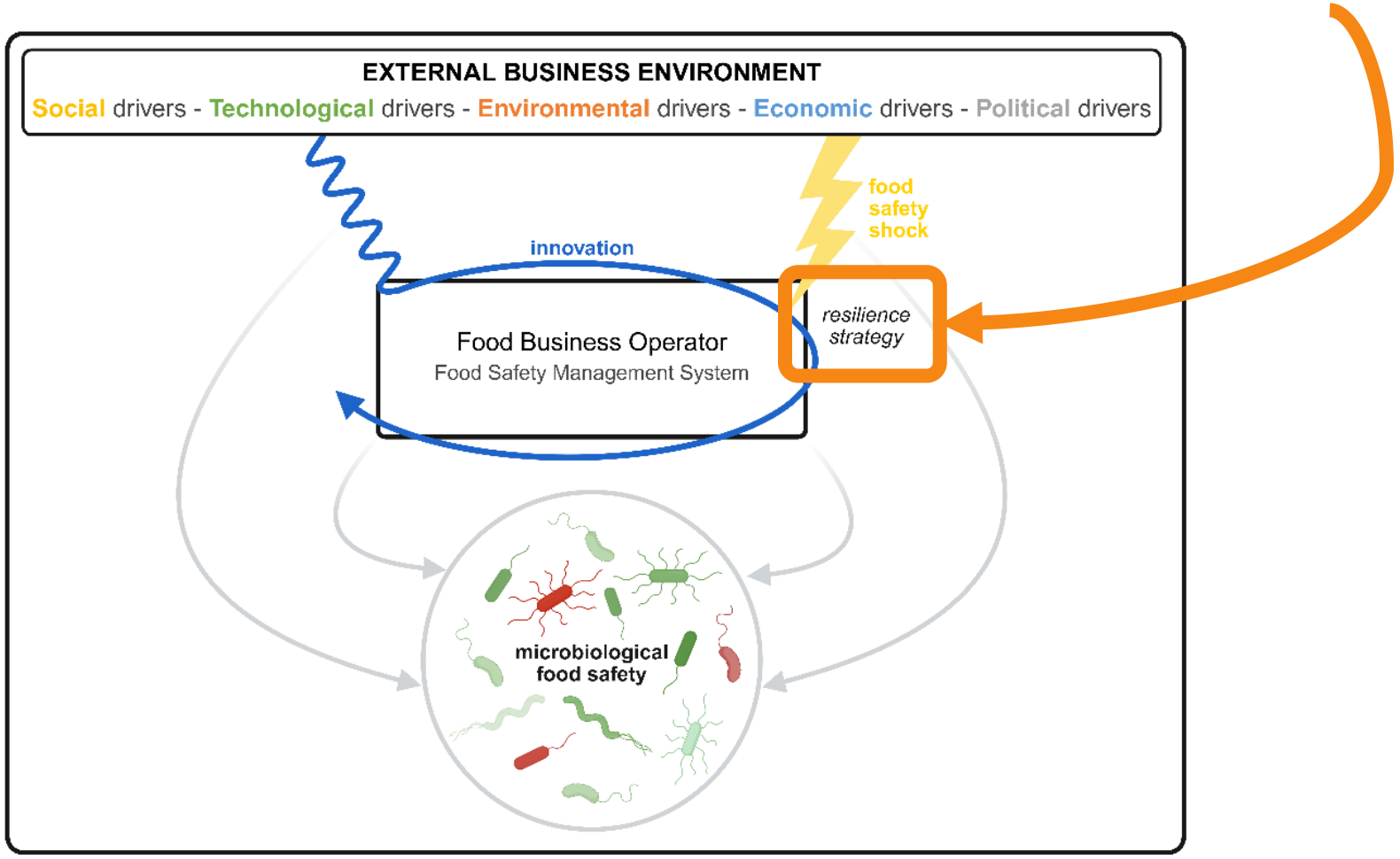

RESEARCH FRAMEWORK

DPSIR model:

(i) ***Driving*** *forces and*

(ii) the resulting environmental ***Pressures****, on*

(iii) the ***State*** *of the Environment and*

(iv) ***Impacts*** *resulting from changes in environmental quality and on*

(v) the societal ***Response*** *to these changes in the environment*

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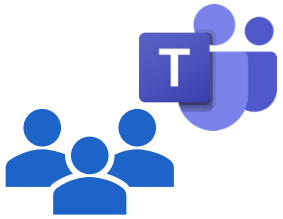
MATERIALS & METHODS – 2 WORKSHOPS

- Workshop 1 - MS Teams
- Workshop 2 - in person



- Workshop 1 - 24 FBOs
- Workshop 2 – 16 FBOs

- **Drivers → Pressure – Impact**
  - **Drivers**: → direct impact on FSM: YES/NO
    - **Pressure**: ~ microbiology
    - **Impact**: ~ core elements of FSMS + mechanism of impact + examples
- **Response**
  - **Questionnaire (FBO level)**
    - Resilience strategies
  - **Group discussion (food systems approach)**

COMPANY CHARACTERISTICS

Company characteristics		Workshop 1	Workshop 2
Total number of participating organisations		**24 → 21 food processing companies**	**16 food processing companies**
Part of a corporate group	- Yes	52%	81%
Family-owned company	- Yes	90%	81%
Number of full-time employees	- 10-49 (small) - 50-249 (medium) - >249 (large)	29% 23% 47%	12.5% 25% 62.5%
International export, outside of Europe	- Yes	76%	81%
Certificates	- BRC - IFS - FSSC 22000	24% 86% 19%	56% 69% 12.5%

Case study in the Belgian food processing industry.

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DPSIR – DRIVERS

➔ **OVERALL RANK: importance + feasibility**

1. Legislation, policies and governance
- **Food legislation**

2. Climate change
- **Temperature change & Extreme weather events**

3. Legislation, policies and governance
- **Good practices and standards**

4. Technologies in food processing
- **Processing techniques and scale**

5. Consumer behaviour
- **Consumer awareness and attitude**

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DPSIR – PRESSURE

- Drivers → **Pressure**: ~ microbiology

Pressures influence food safety and suddenly (cfr. food safety shocks) cause changing (expected) levels of microbiological contamination, growth, or survival, specifically of human pathogens or undesired micro-organisms.

5 general pressures were identified:

- Changes in **raw materials**, influencing microbiology
- Changes in **storage and distribution**, influencing microbiology

- Changes in **product design**, influencing microbiology
- Changes in **food processing technologies** or parameters, including packaging, influencing microbiology

- Changes in **stakeholder requirements**, influencing microbiology

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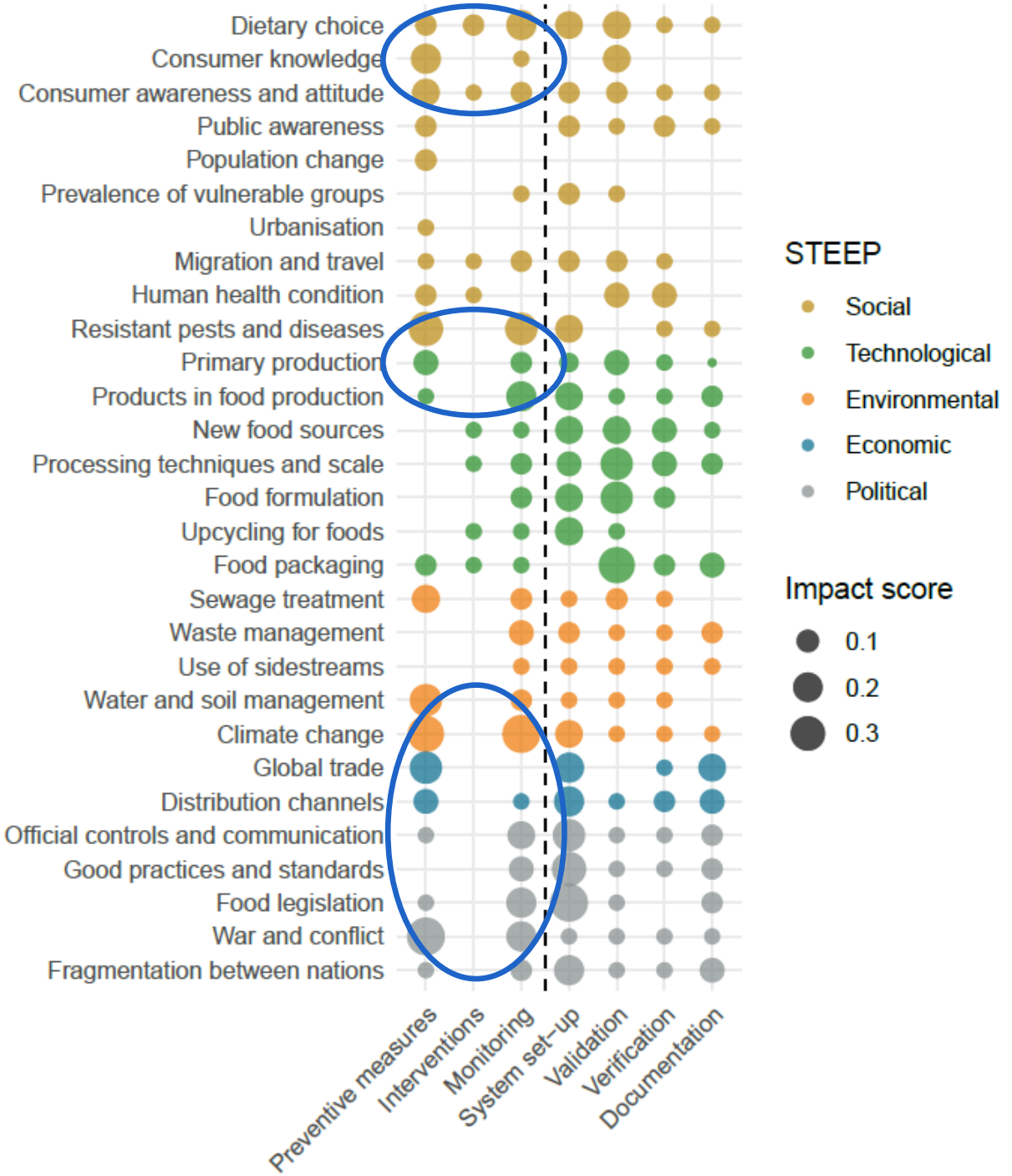
DPSIR – IMPACT

- **Drivers** → **Pressure** → **State & impact**

- Changes in **raw materials**
  - Consumer behaviour
  - Primary production
  - Climate change
  - Global trade
  - War and conflicts



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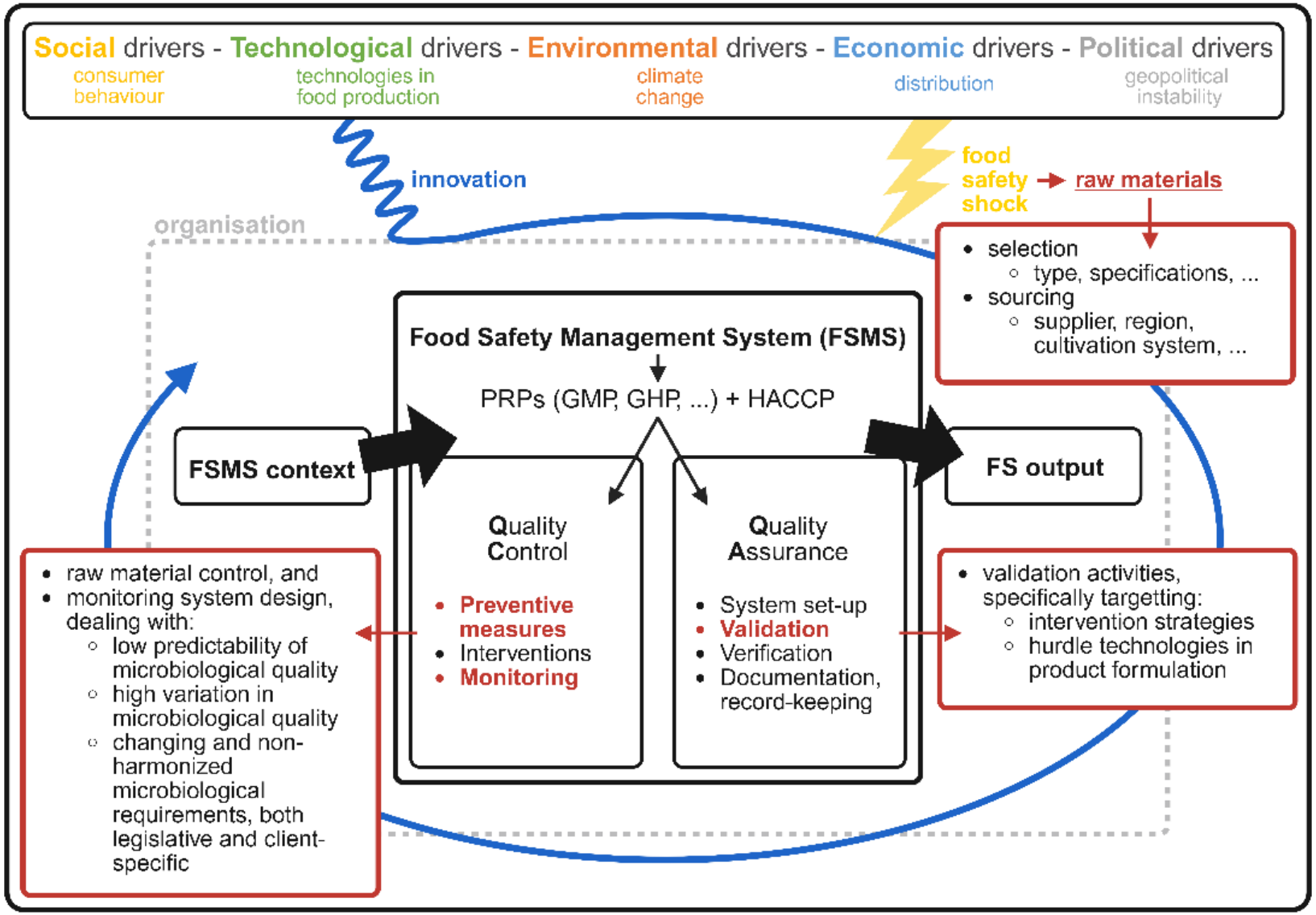
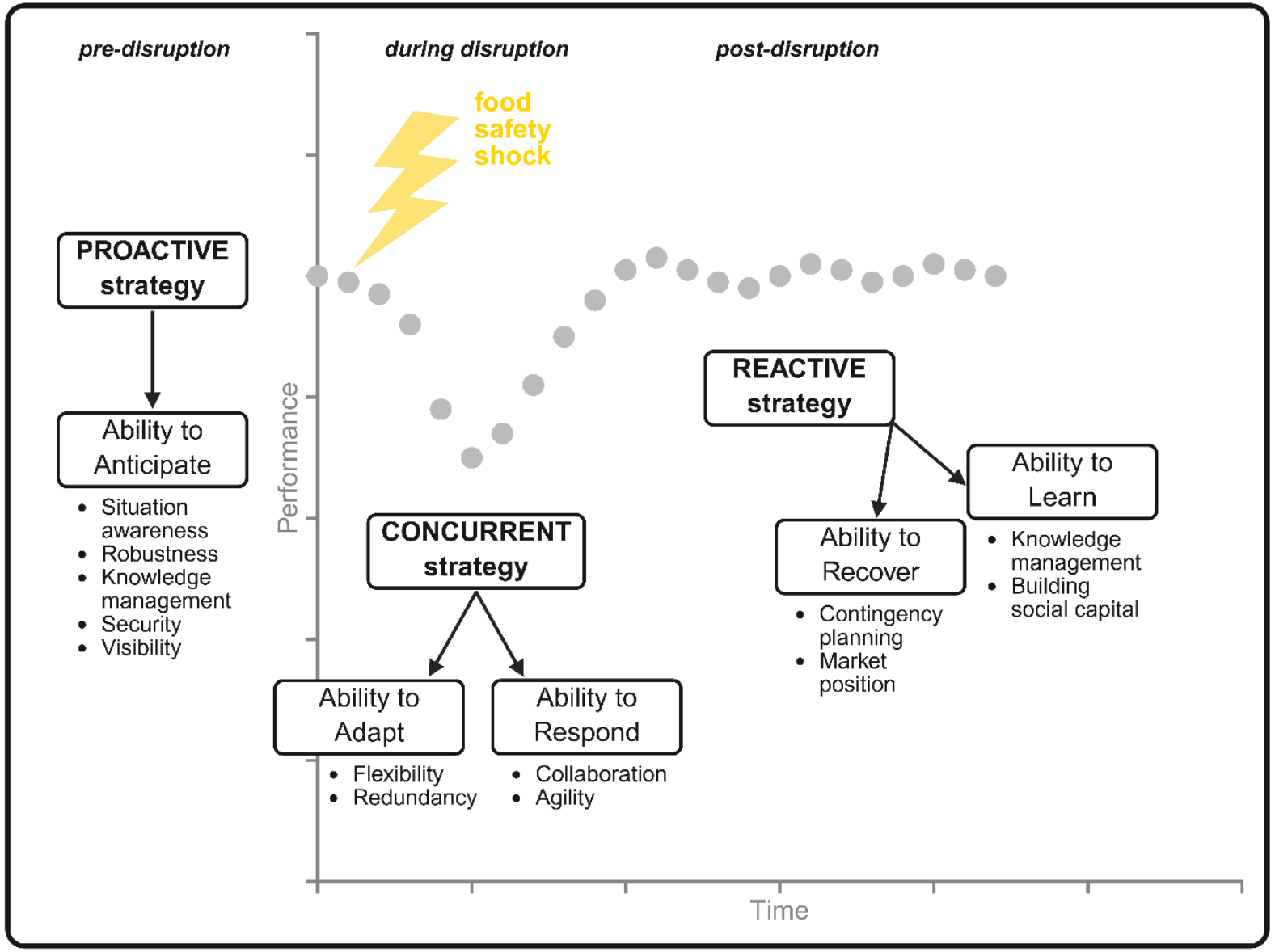
DPSIR – IMPACT

- Drivers → **Pressure** → State & impact

- Changes in **raw materials**



DPSIR – RESPONSE



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DPSIR – RESILIENCE STRATEGIES @ FBO LEVEL

PROACTIVE

Resilience elements	Resilience strategies
Situation awareness	• early warning and foresight tools • RASFF • monitoring of regulatory requirements and proactive impact- or risk-assessment. • trend analysis and predictive modelling tools
Robustness	• FSMS design
Visibility	• supplier selection criteria and microbiological specifications • information and microbiological test results • site visits and audits
Knowledge management	• General staff training • Proactive management of changing external factors: skilled experts • crisis response team: regular trainings and simulations for incident and crisis management.

- Drivers → **Pressure** → State & impact → **Response**

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DPSIR – RESILIENCE STRATEGIES @ FBO LEVEL

CONCURRENT

Resilience elements	Resilience strategies
Flexibility	• Diversified sourcing, storage and distribution: multiple suppliers, external warehouses, and distributors. • Operational flexibility: internal storage, processing and packaging operations. • Flexible quality control measures.
Redundancy	• Switching to alternative suppliers, storage facilities and distribution companies. • Buffers and maintaining adequate stock levels.
Agility	• Change management and incident or crisis management procedures. • Direct communication channels with all stakeholders.
Internal collaboration	• Active alignment of different departments considering microbiological food safety: adopting a food safety-by-design approach.

- Drivers → **Pressure** → State & impact → **Response**

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DPSIR – RESILIENCE STRATEGIES @ FBO LEVEL

REACTIVE

Resilience elements	Resilience strategies
Contingency planning	• Procedures for blocking, change management, incident and crisis management, etc. • Root cause analysis.
Knowledge management	• Communication of incident details to all employees and integrating learning opportunities from past incidents into food safety training sessions.
Building social capital	• Building inter-organisational relationships to strengthen learning.

- Drivers → **Pressure** → State & impact → **Response**

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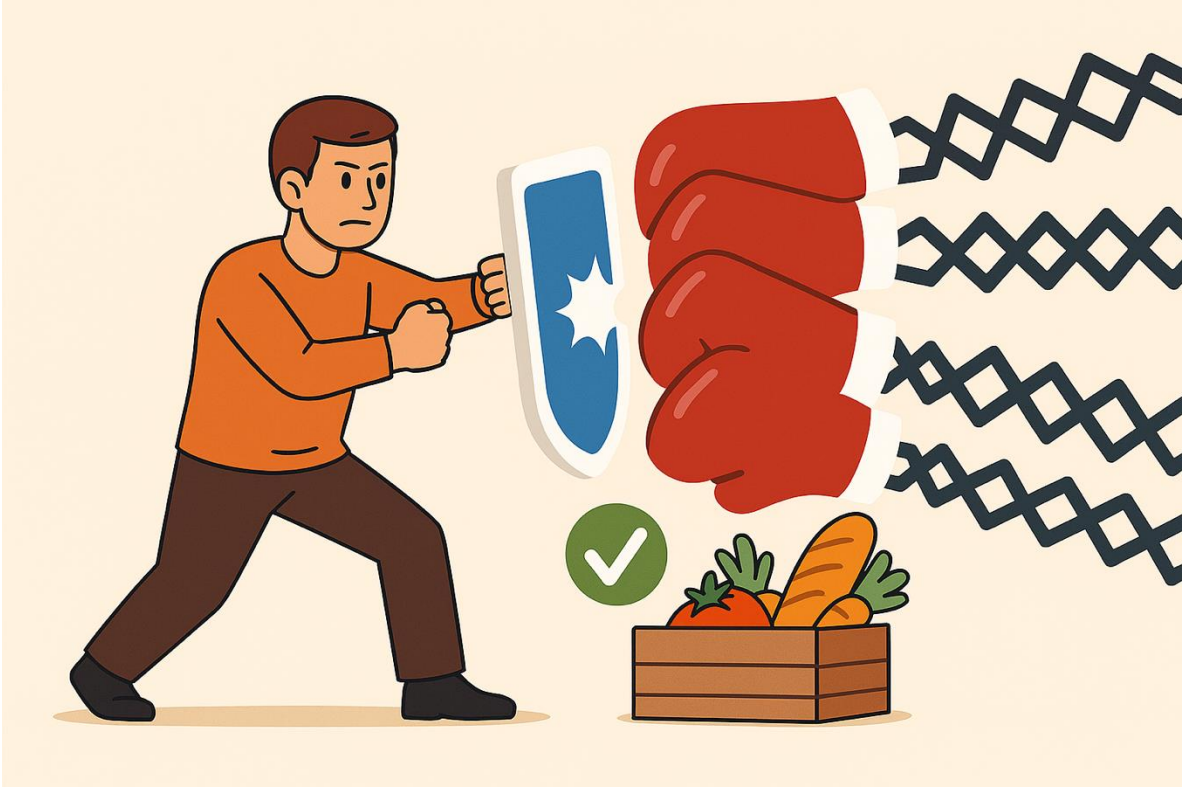
DPSI**R** – RESILIENCE STRATEGIES @ CHAIN LEVEL

- **Continuous approach**
- **Collective approach**

- **FSMS**
- **Food Safety Culture**



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CONCLUSIONS

- Drivers of change → food safety shocks
- Identification and monitoring of relevant drivers of change
- → DPSIR framework

- Flexible QC/QA, information ↑, understanding ↑
  - **Food safety output:** predictability ↑ and controllability ↑
  - Awareness ~ external business environment

- Resilience: a collective and continuous approach
  - **Food safety culture**

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SELF-ASSESSMENT TOOLS

TOOL 1: drivers of change ~ impact FSMS

TOOL 2: resilient response strategies

Target audience:

- FBO
- Sector association
- Risk manager

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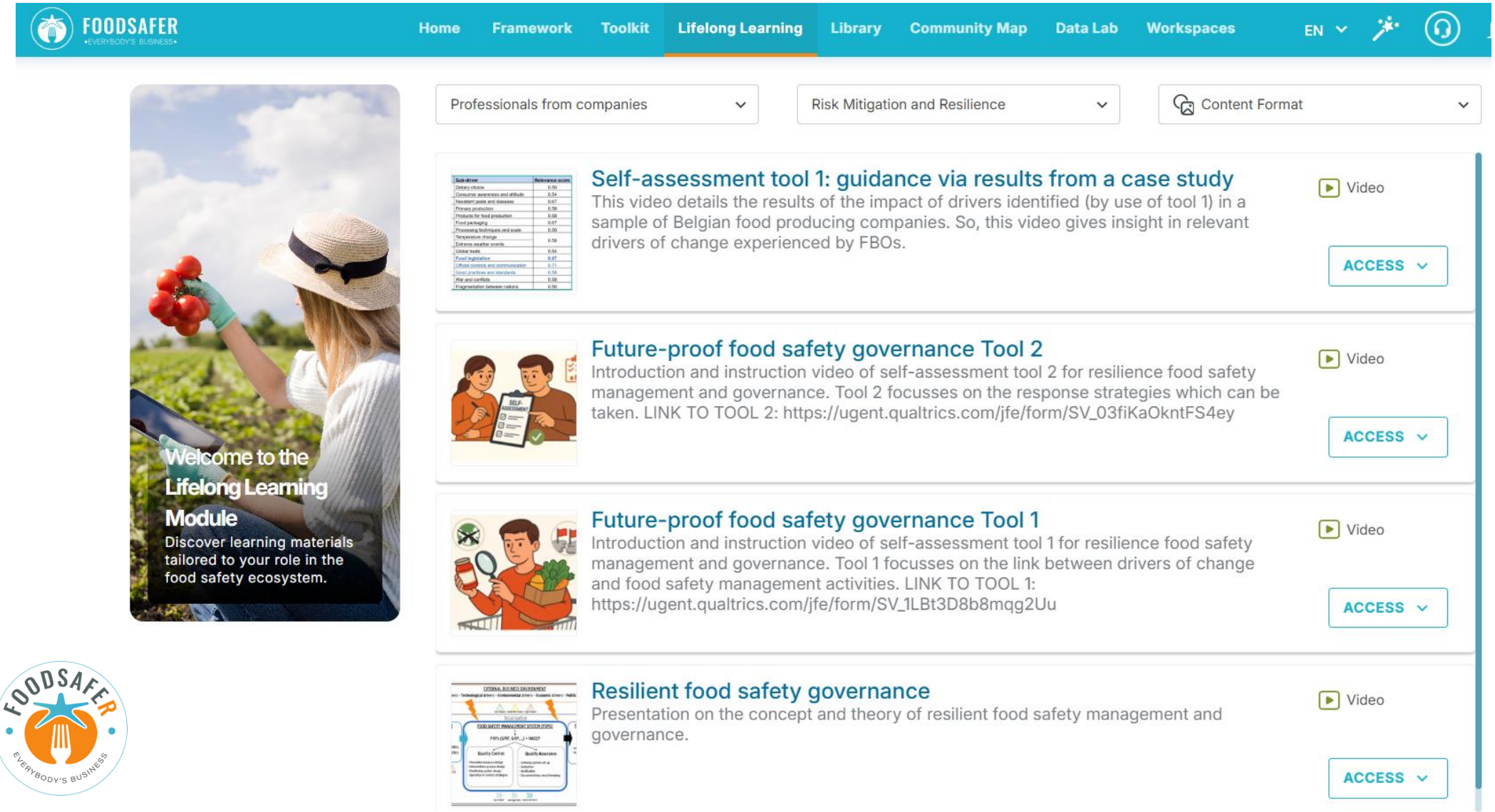

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