DATA ANALYSIS FOR THE IDENTIFICATION OF EMERGING FOOD SAFETY RISKS

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INTRODUCTION
EMERGING RISK DEFINITION

- 'An emerging risk to human, animal and/or plant health is understood as a risk resulting from a newly identified hazard to which a significant exposure may occur or from an unexpected new or increased significant exposure and/or susceptibility to a known hazard'
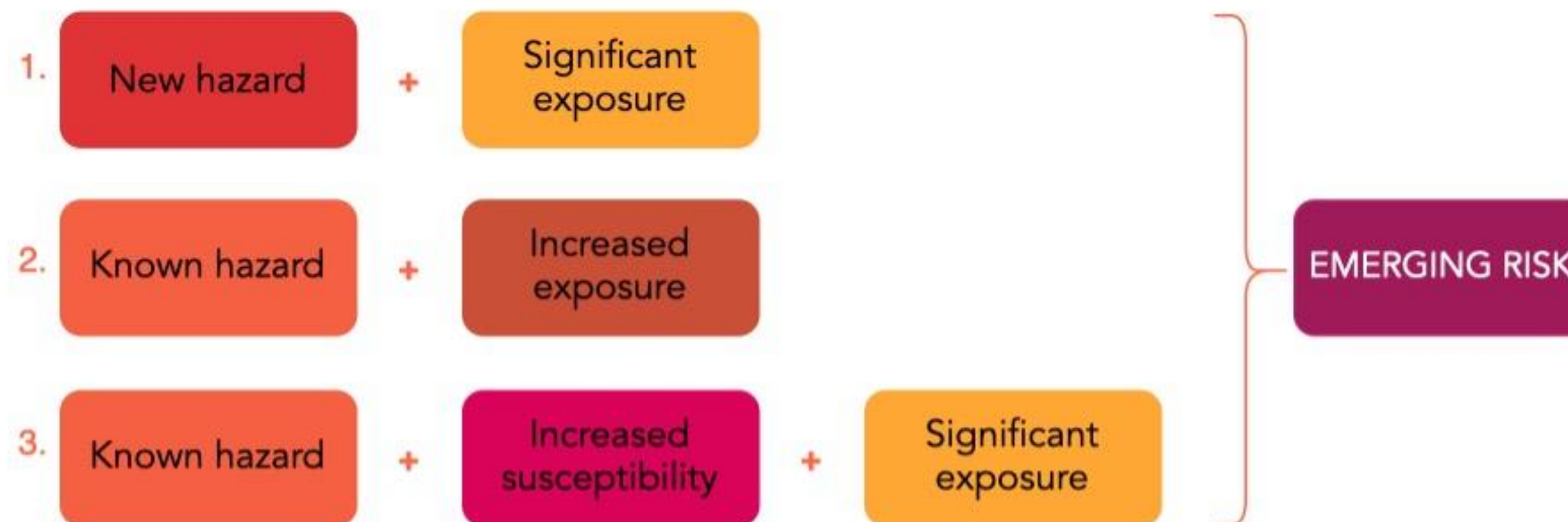
- **RISK BASED APPROACH**: Timely identification of food systems risks needs a profound knowledge on the prevalence and severity of risks

- Continuous evaluation of risks and continuous knowledge genaration → complex process

TIMESCALES

EMERGING ISSUE IDENTIFICATION

EARLY WARNING

SHORT TERM

Rapid alert systems

Immediate action required

Ongoing outbreaks/incidents somewhere else

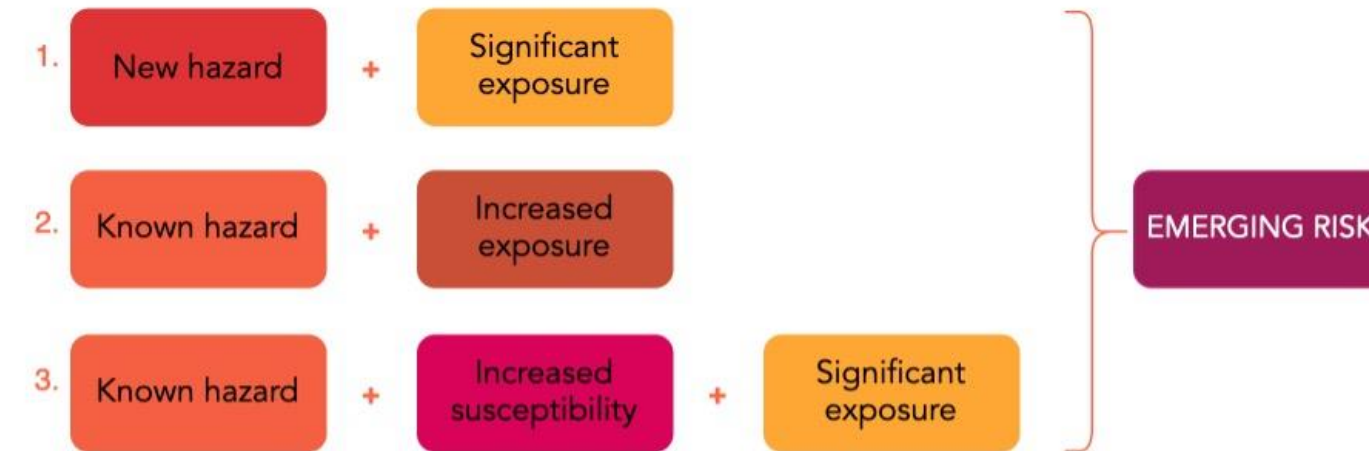## EMERGING RISK IDENTIFICATION

MEDIUM TERM

Screening systems

Increases preparedness

FORESIGHT

LONG TERM

Driver and scenario analysis

Affects strategic actions

RASFF
Rapid Alert System for Food and Feed

INFOSAN

1.	New hazard	+	Significant exposure		
2.	Known hazard	+	Increased exposure		EMERGING RISK
3.	Known hazard	+	Increased susceptibility	+	Significant exposure

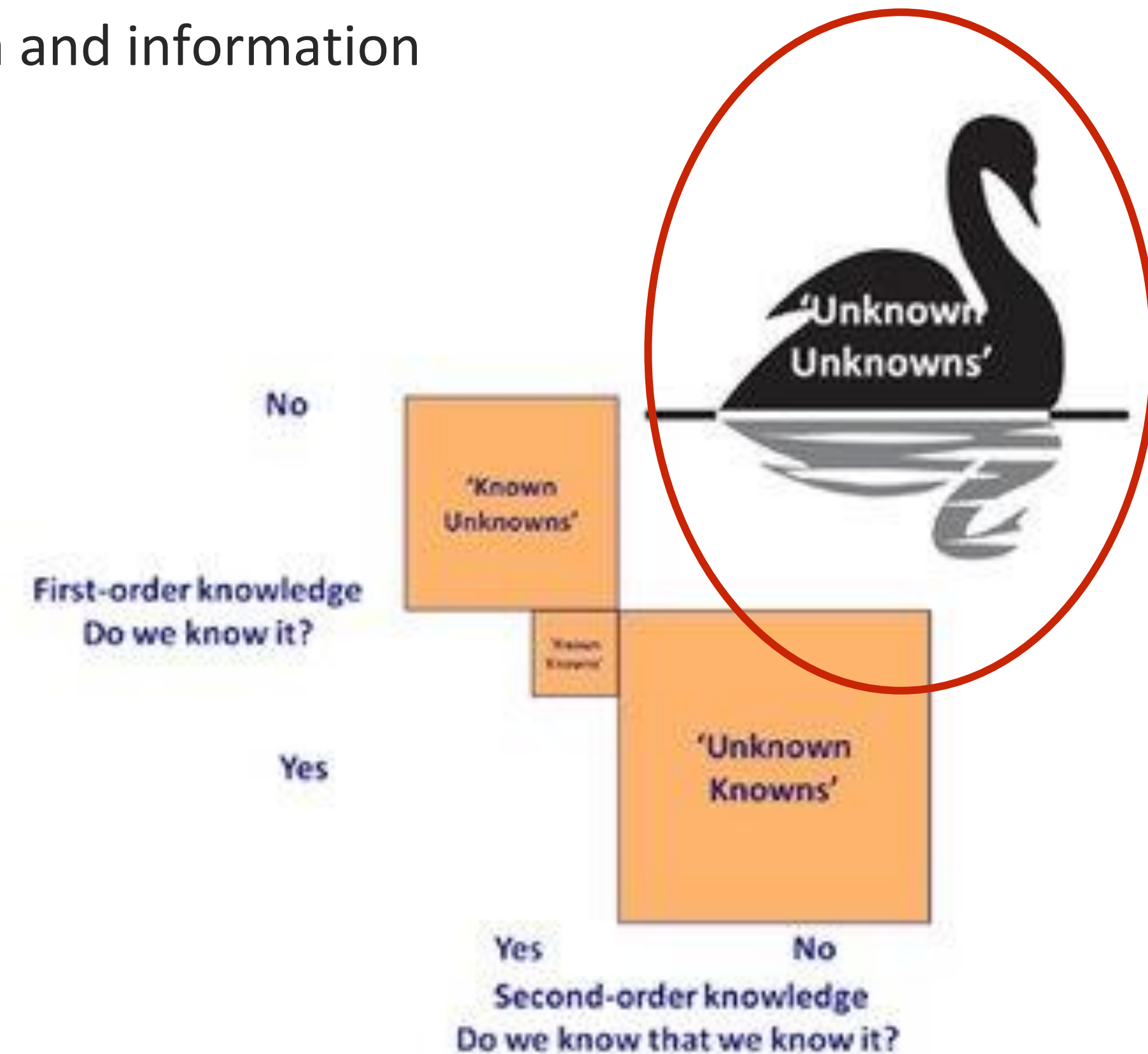POPULATION GROWTH

GLOBAL TRADE

DEPLETION OF NATURAL RESOURCES
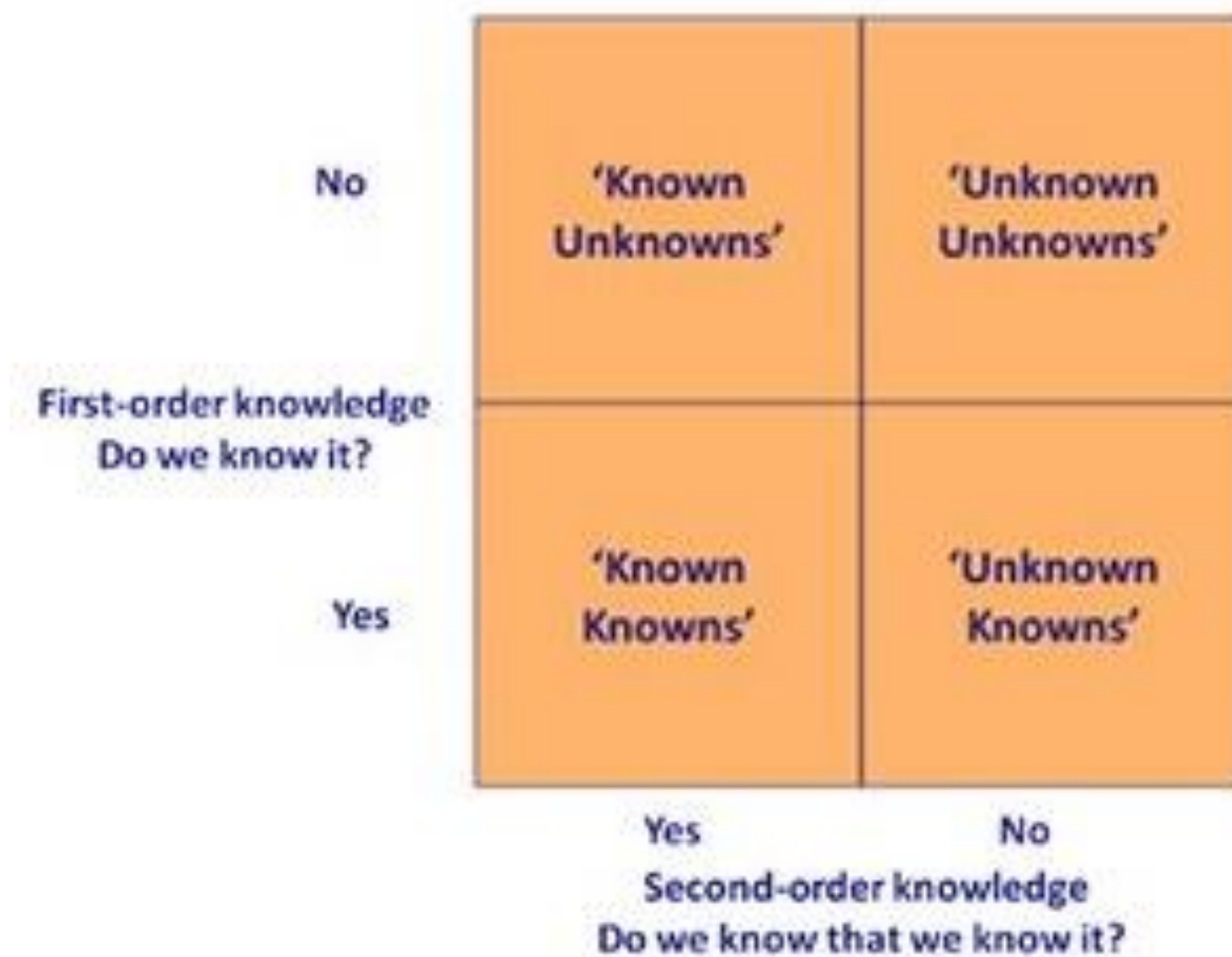
CLIMATE CHANGE

TECHNOLOGICAL DEVELOPMENT

CHALLENGES

- Finding the "next food systems issue"

- Systematic analysis of short, medium and long timescale data and information

- Challenges: data/information gaps, different timescales etc.

Source: De Spiegeleire, Stephan & Bekkers, Frank. (2012). Who says generals can't dance: Strategic agility and defence capability options.
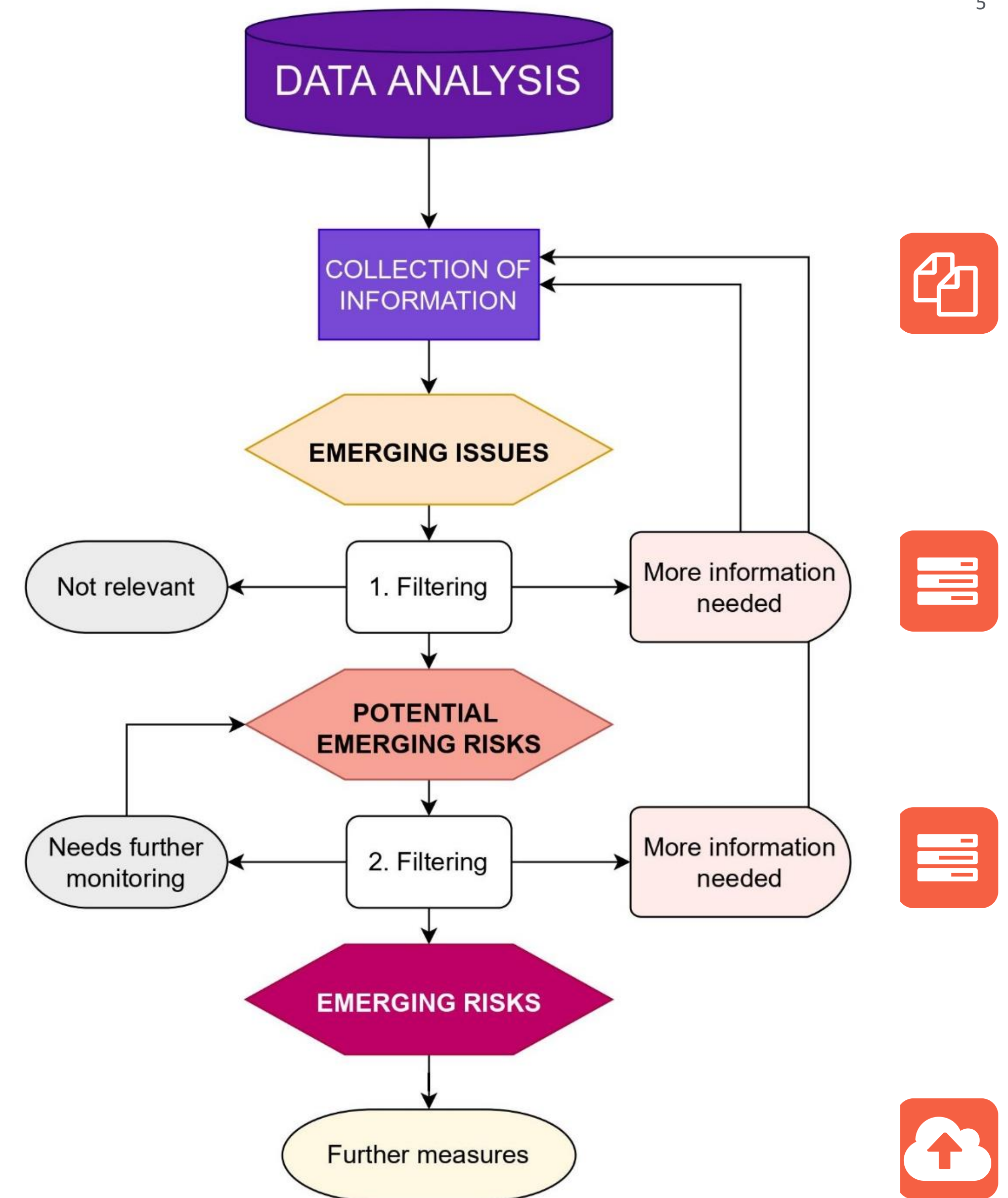
ERI
SYSTEMATIC APPROACH

- Anticipation of upcoming risks → preparation for future challenges

- **New hazards / increased exposure / new susceptible group**

- Process:

  1. Collect and collate information

  2. Analyze and filter

  3. Share information

ERI

SYSTEMATIC APPROACH

COLLECTION AND COLLATION OF DATA & INFORMATION

- Screening various data & information sources
  - media and scientific literature
  - data from food safety authorities
  - patent databases
- Collecting expert knowledge

ANALYSIS AND FILTERING

- Characteristics assessed:
  - novelty, significance, susceptibility
- Prioritization: evaluation based on pre-defined criteria
  - soundness, imminence, scale, severity
  - risk management situation

SHARING

- Risk management/preparedness:
  - new procedures, modifying HACCP plans, etc.
- Communication with various target audience:
  - consumers, business, authorities
- Research

TOOLS & METHODS

- Automated data retrieval, Text mining, Data mining, Network analysis, AI&ML, Visualization
- Multidisciplinary team with high level expertise

DATA/INFORMATION SOURCES

SOURCES FOR EMERGING ISSUE IDENTIFICATION SYSTEM OF THE DIGITAL FOOD INSTITUTE

Rapid alert systems (mainly RASFF, INFOSAN)

News (with global coverage)

Social media news aggregating services

Sample and control data from European food safety authorities

Patent databases (WIPO, EPO, USPTO)

Scientific publication databases (PubMed, Science Direct, Web of Science, CAB Abstract, FSTA Abstracts)

Collecting expert knowledge

DATA ANALYSIS

IDENTIFYING TRENDING TOPICS IN NEWS
BASED ON TEXT MINING AND NETWORK ANALYSIS
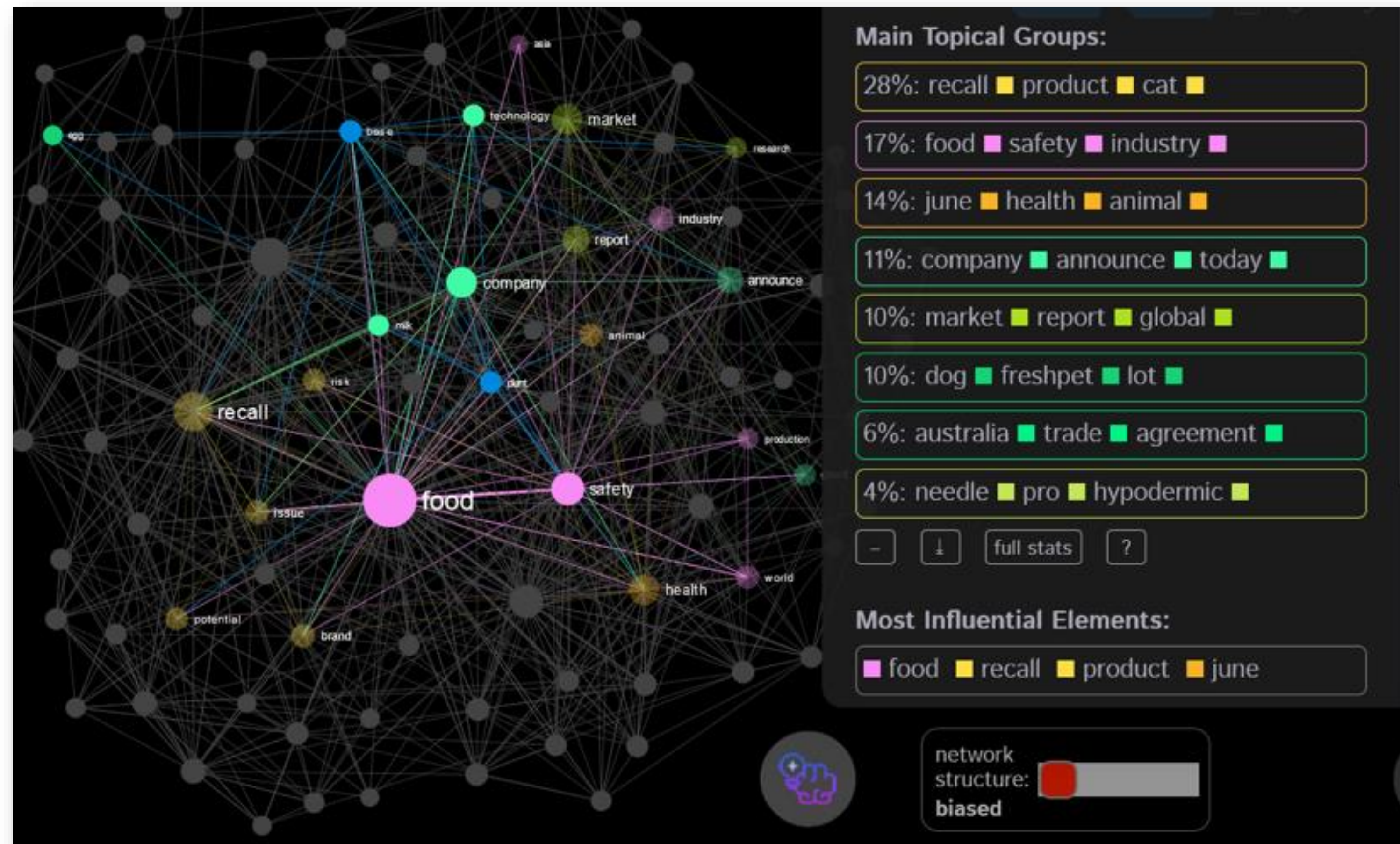
PATENT NETWORK ANALYSIS: INTELLECTUAL ECOLOGY

- We want to capture the evolutionary aspect of the patent universe

- The dynamic network can be conceived as a kind of **intellectual ecology**

- Bray-Curtis dissimilarity:

  - used in numerical ecology and biology

  - convergence or divergence – formation of new technological areas

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B63
F42
B25
H05
F15

Y

0.2
0.1
0.0
−0.1
−0.2
−0.3

Z

−0.2   −0.1   0.0   0.1   0.2   0.3   0.4   0.5
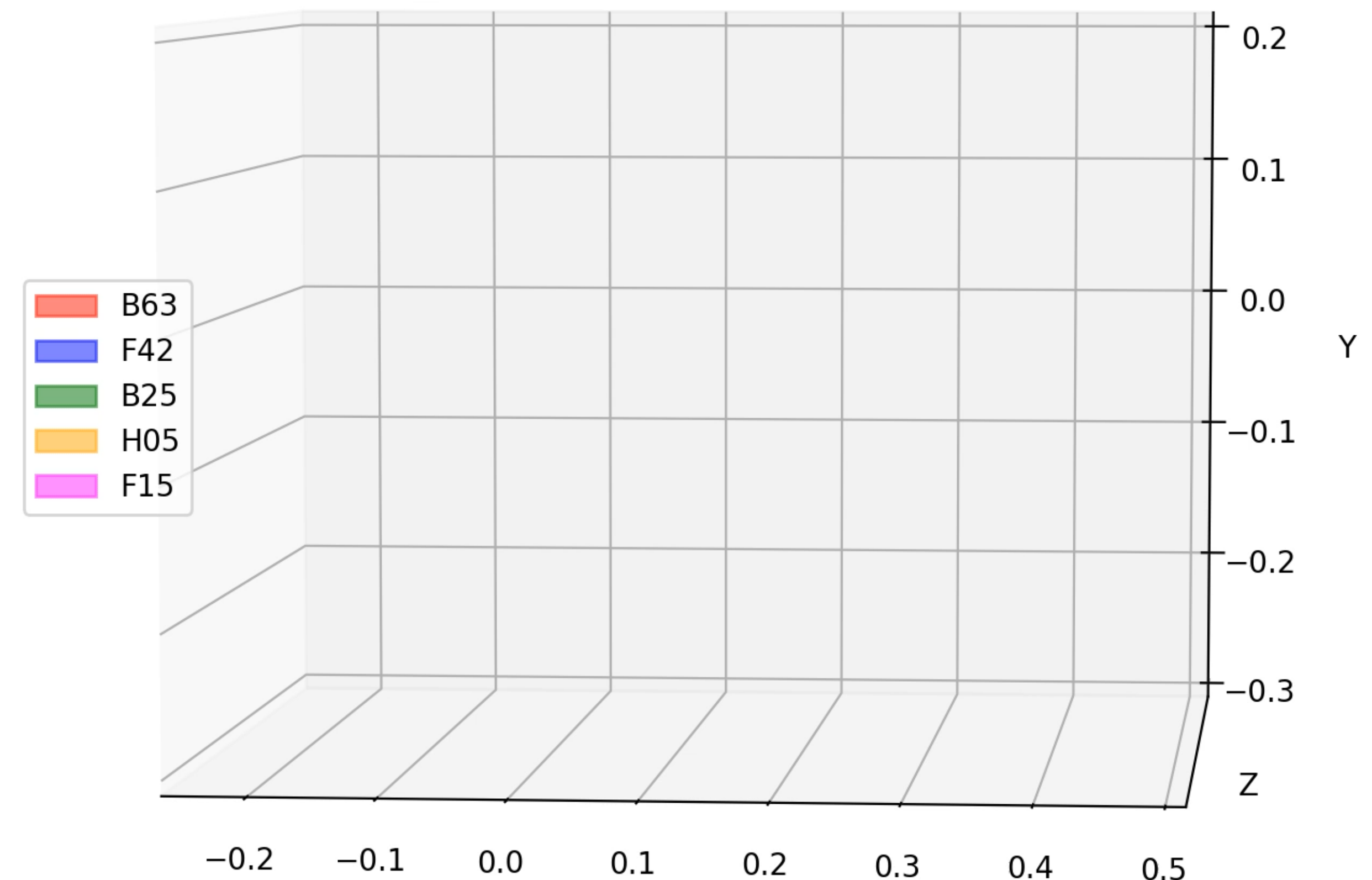
EMERGING ISSUES: EXAMPLE

PRACTICAL EXAMPLES

EMERGING ISSUES

POSSIBLE RISK MITIGATION ACTIONS

DATA AND INFORMATION COLLECTION & ANALYSIS

EARLY WARNING SYSTEM AND INDICATOR ALERT SYSTEM

EMERGING RISK IDENTIFICATION

FORESIGHT

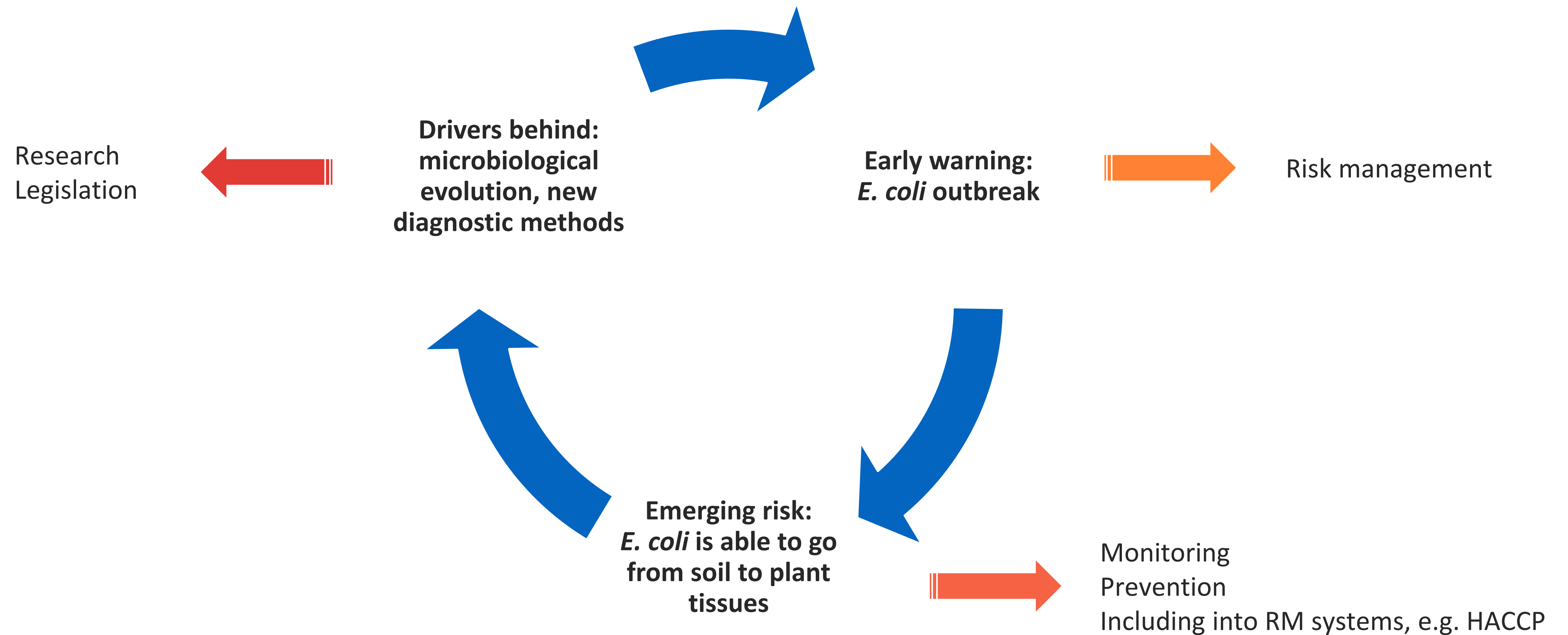| EMERGING ISSUES	POSSIBLE RISK MITIGATION ACTIONS
Significant number of RASFF alerts on aflatoxin in almonds	Increased frequency of supplier audits/samplings of almond consignments
Quality problems with dairy products in multiple countries	No action needed, but information for management and marketing unit
Indicator on usage of antibiotics increases	Increased frequency of supplier audits/samplings of milk producers
Transmission of E. coli from water and soil to plant tissues	Informs HACCP risk analysis; possible modification of the HACCP system in case of relevant products
Mycotoxin contamination affecting new areas	Informs HACCP risk analysis; possible strengthening of the self-checking system regarding mycotoxins
Increasing temperature because of climate change	No immediate action required; informs emerging risk identification process, risk analysis and also long-term business policy decisions (e.g. on research)
Pathogen mutation and adaptation	

EMERGING ISSUES: EXAMPLE

TRANSMISSION OF E. COLI FROM CONTAMINATED WATER AND SOIL TO PLANT TISSUES

Research
Legislation

Drivers behind: microbiological evolution, new diagnostic methods

Early warning:
E. coli **outbreak**

Risk management

Emerging risk:
E. coli **is able to go from soil to plant tissues**

Monitoring
Prevention
Including into RM systems, e.g. HACCP

SUMMARY
KEY MESSAGES

- Basis of resilience is prediction and prevention

- Strategic & systematic approach: assessment of short, medium and long timescale trends

- It is important to invest into data generation, data sharing, and data analysis

- Advanced data analysis can help in identifying important issues from an extremely noisy environment.

- **But expert knowledge is still important: data validation, choosing the right analysis framework, interpretation of the results, etc.**

THANK YOU FOR YOUR ATTENTION

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