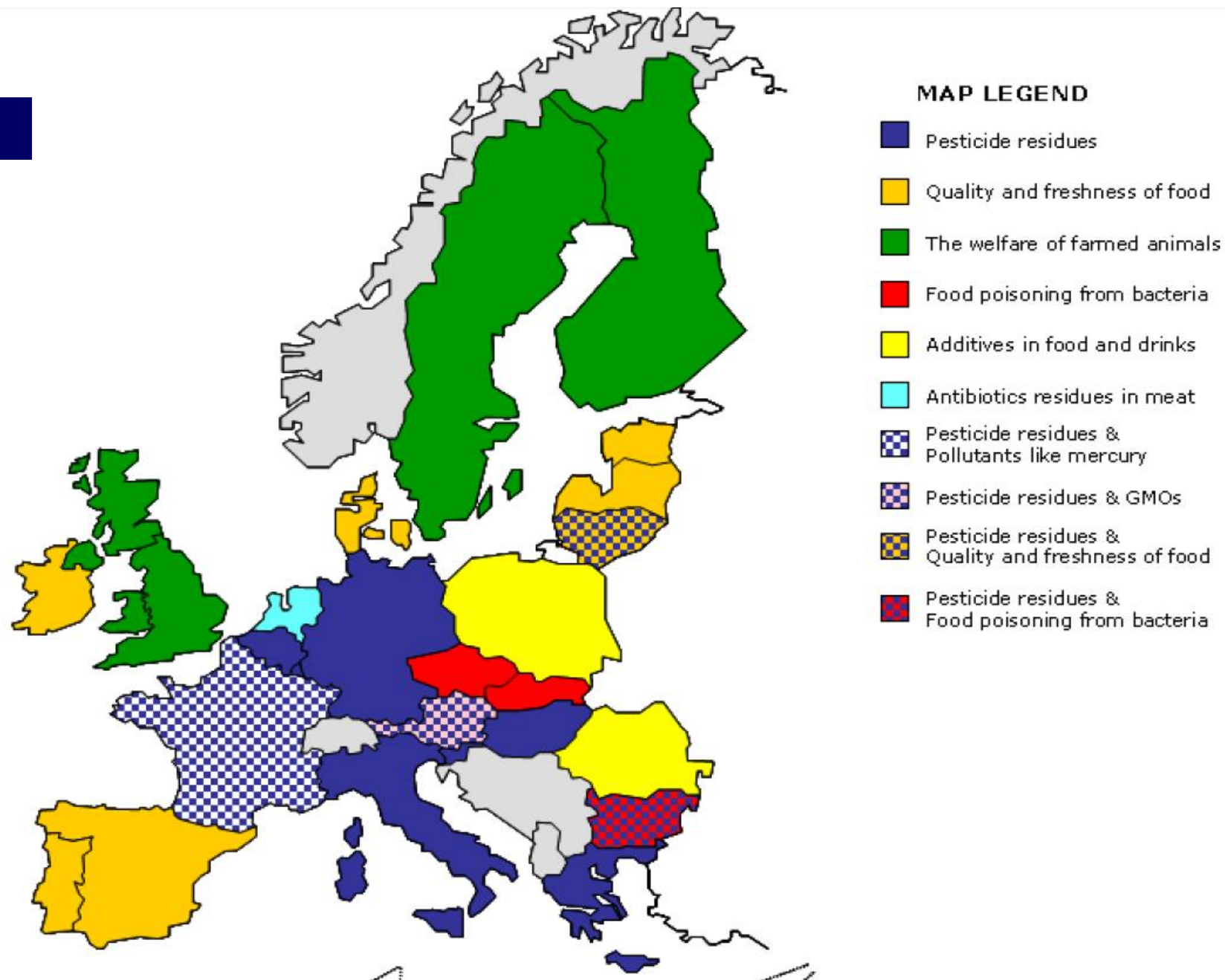


Food safety risk assessment tools – virtual exercises

Bernd Appel and the global food
chain team

2010 Eurobarometer survey report on risk perception in the EU

Top Concerns



Food-borne zoonotic diseases in Europe

A common, costly - yet preventable - public health problem.

In the European Union (EU), **over 320,000 human cases** are reported each year, but the real number is likely to be much higher.

The EU has adopted an **integrated approach to food safety** from the farm to the fork.

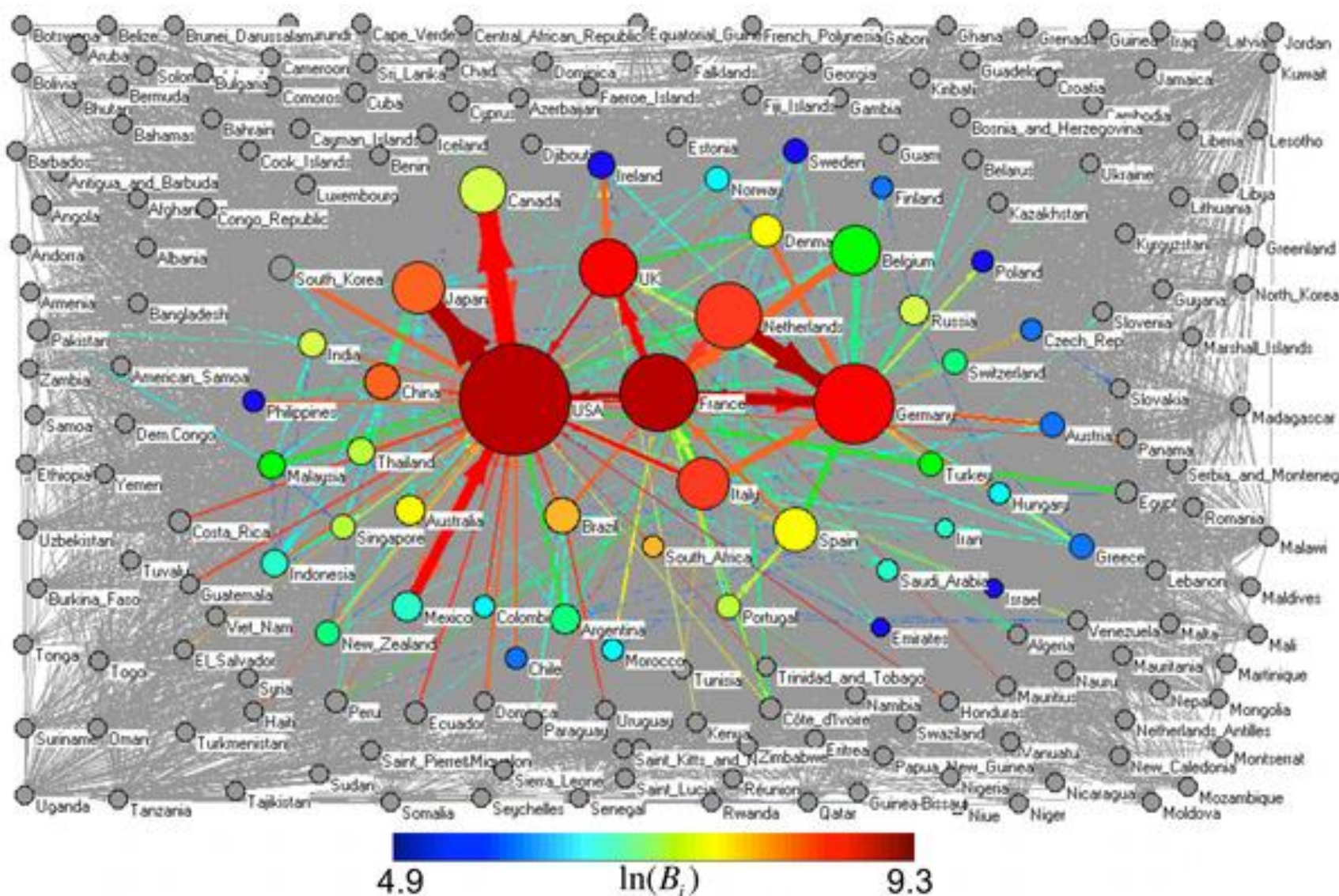
The approach is supported by timely and effective risk communication activities.

A total of 5,363 food-borne outbreaks were reported in the European Union, resulting in 55,453 human cases, 5,118 hospitalisations and 41 deaths (2012).

Most of the reported outbreaks were caused by *Salmonella*, bacterial toxins, viruses and *Campylobacter*. The most important food sources of the outbreaks were eggs and egg products, followed by mixed food and fish and fish products.

Source: *efsa*

Are we prepared for risk assessment in global food chains?



The complete International Agro-Food Trade Network in 1998.

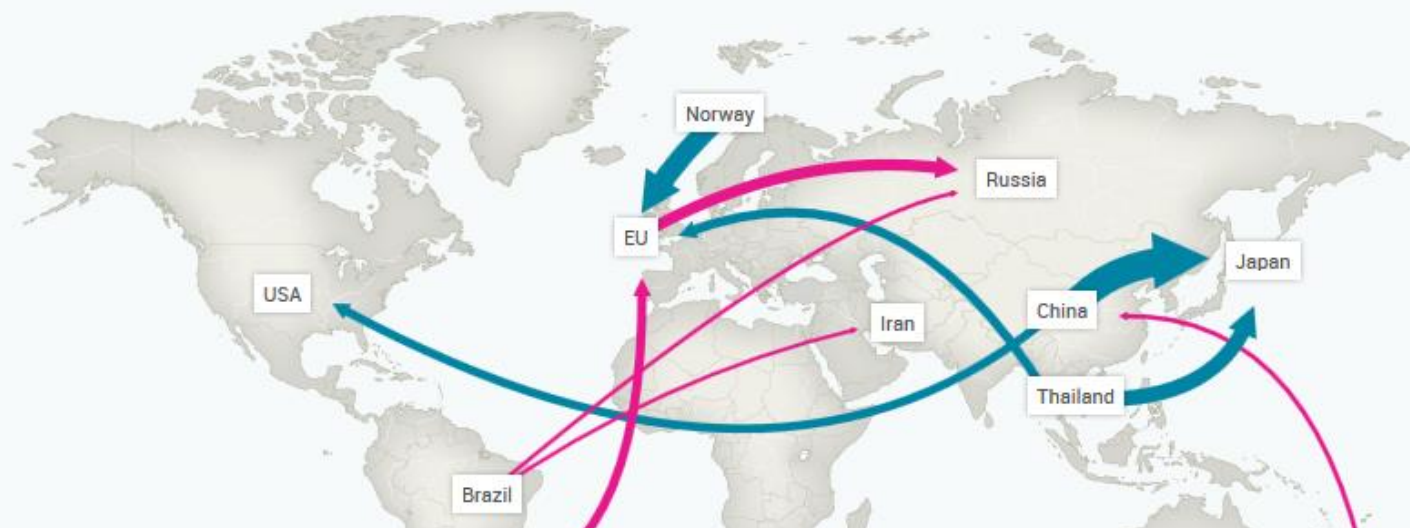
Ercsey-Ravasz M, Toroczkai Z, Lakner Z, Baranyi J (2012) Complexity of the International Agro-Food Trade Network and Its Impact on Food Safety. PLoS ONE 7(5): e37810. doi:10.1371/journal.pone.0037810

Global Food Chains

2000 2010



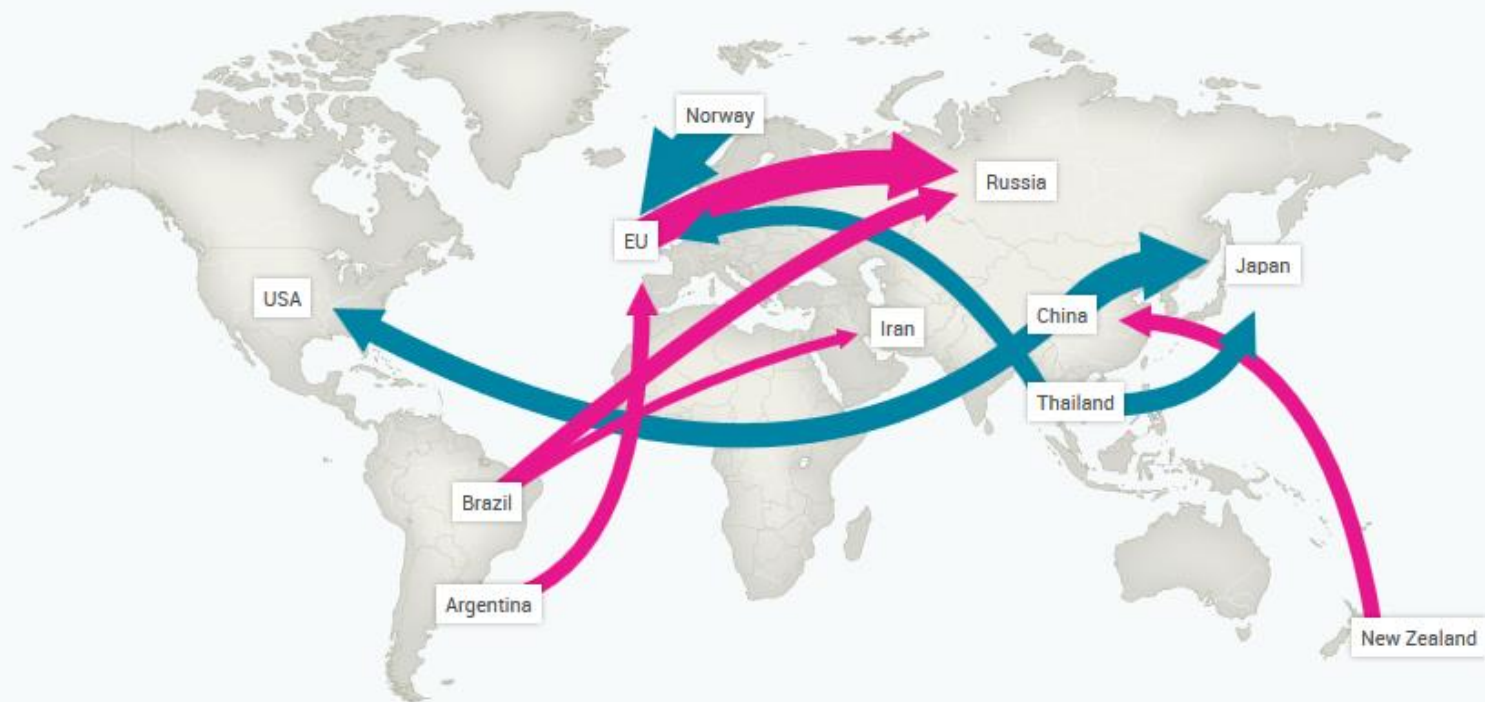
Middle Eastern, Russian, and Chinese imports of meat and fish are increasingly rapidly, and developing countries are becoming increasingly important suppliers.



2000 2010



Middle Eastern, Russian, and Chinese imports of meat and fish are increasingly rapidly, and developing countries are becoming increasingly important suppliers.



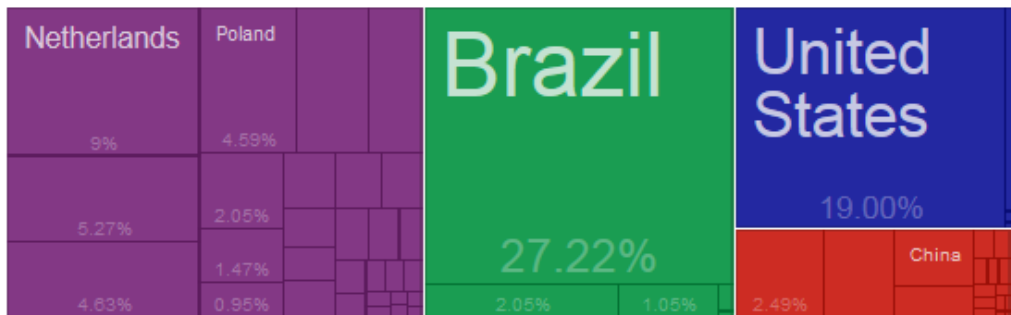
Meat
Fish

Globalisierung von Warenketten

WHICH COUNTRIES EXPORT POULTRY MEAT?

Countries that export Poultry Meat

Total Country Trade: \$25.8B



Continent Country

Gross Net

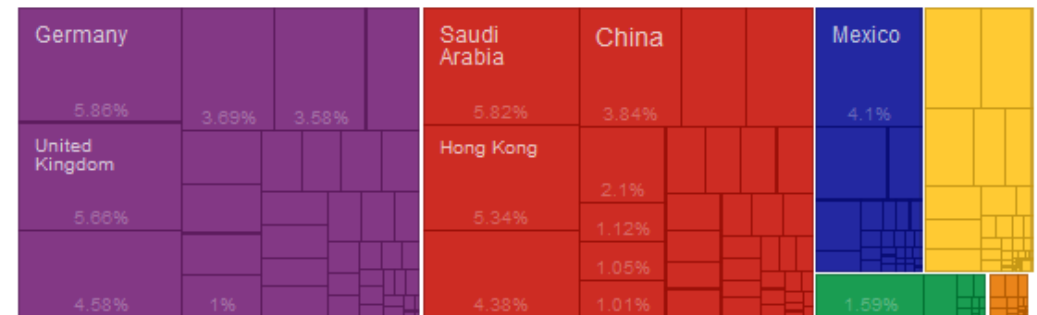
Category

1	BRA	Brazil	\$7,031,095,420.08	27%
2	USA	United States	\$4,907,603,801.83	19%
3	NLD	Netherlands	\$2,324,628,265.62	9.0%
4	FRA	France	\$1,360,590,814.65	5.3%
5	DEU	Germany	\$1,195,452,012.71	4.6%

WHICH COUNTRIES IMPORT POULTRY MEAT?

Countries that import Poultry Meat

Total Country Trade: \$26B



Continent Country

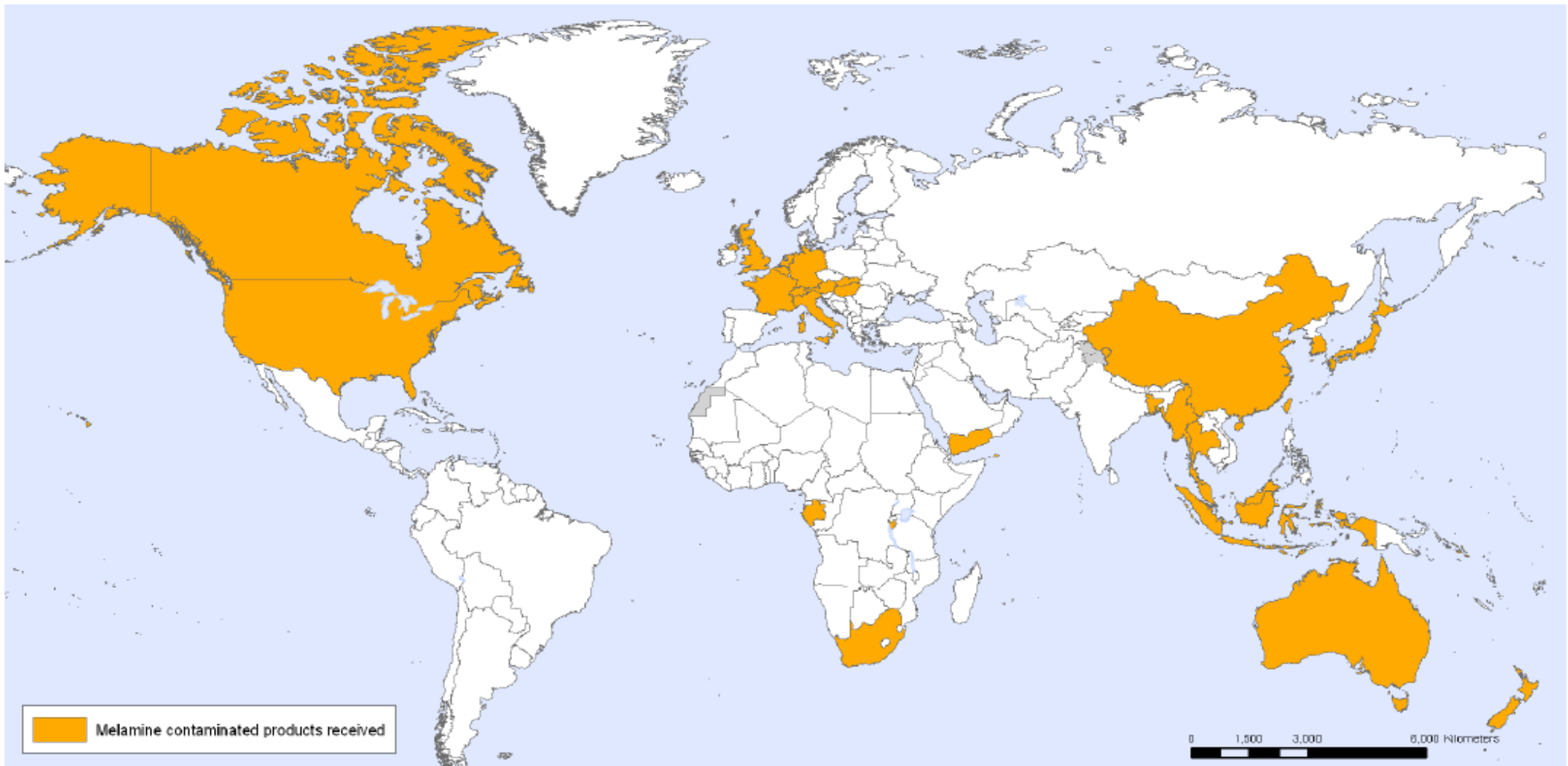
Gross Net

Category

1	DEU	Germany	\$1,524,817,886.54	5.9%
2	SAU	Saudi Arabia	\$1,513,309,830.00	5.8%
3	GBR	United Kingdom	\$1,472,665,274.40	5.7%
4	HKG	Hong Kong	\$1,388,939,177.68	5.3%
5	FRA	France	\$1,191,134,837.07	4.6%

<http://atlas.media.mit.edu/profile/hs/0207/>

Melamin – world wide distribution



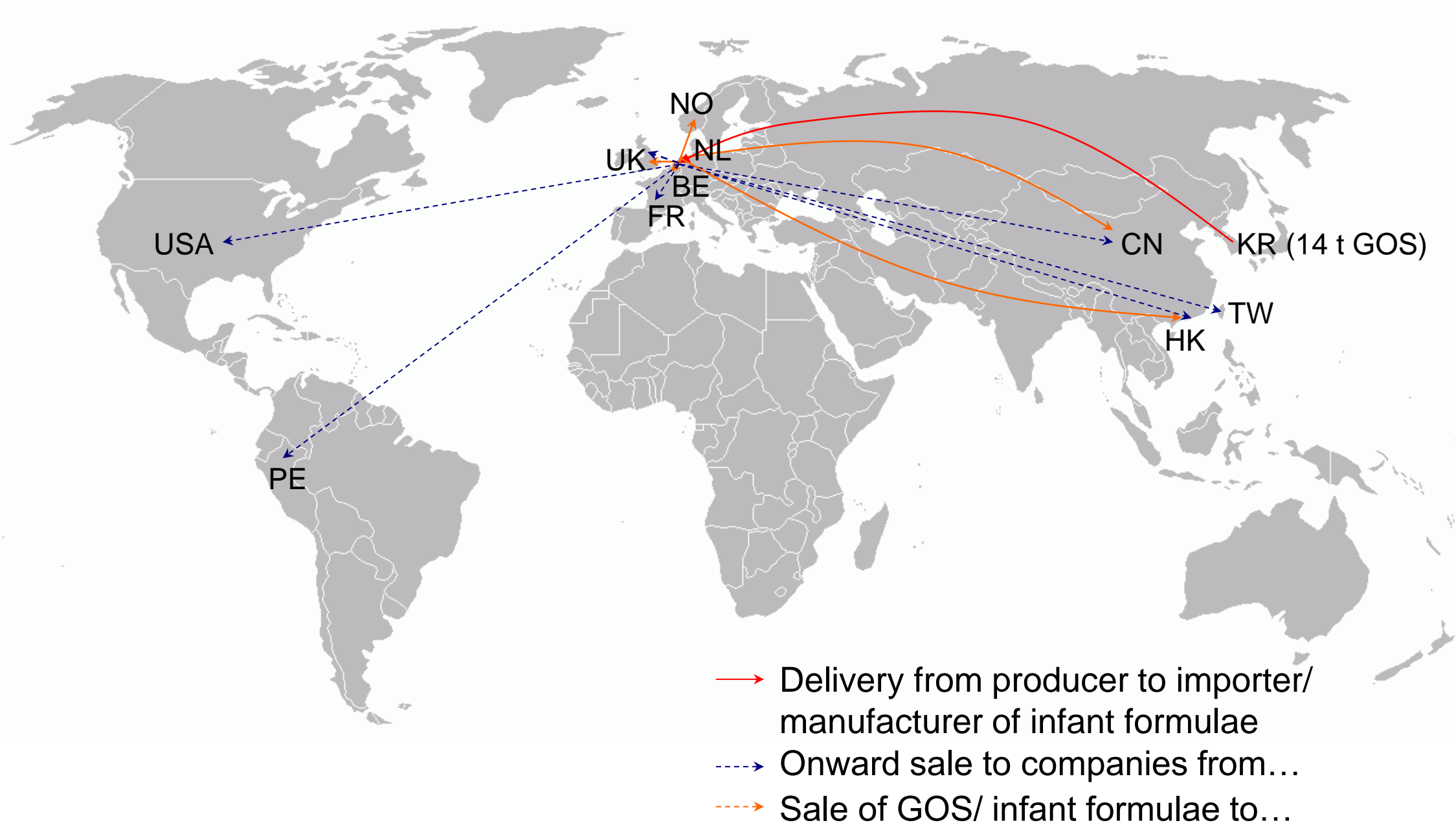
Weltweite Produktion von Melamin 2007 → 1,2 Millionen Tonnen



(Source: Bizzari and Yokose, 2008)

© WHO 2008. All rights reserved

Distribution of GOS (RASFF 2012.0929)



Global food chains -

a challenge for risk assessors



- **Costumers purchase behaviour** is changing massively due to free market economy
 - **Dissolution** from **local production** and supply
 - Highly competitive environment => **cheap priced foodstuff**
 - Differences with respect to regulations: **import regulations**, border controls, statutory requirements, internet trade
- => Do we have the **right information, methods and tools** for effective quality management and **risk assessment**?

Risk Assessment refers to the Food Chain



feed & animals



slaughter

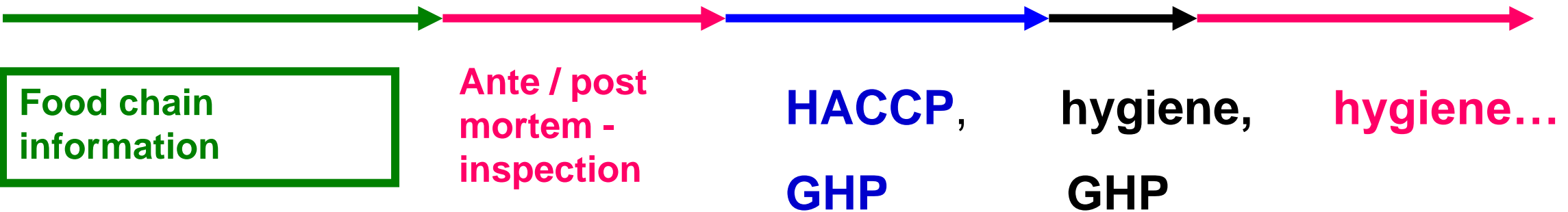


processing



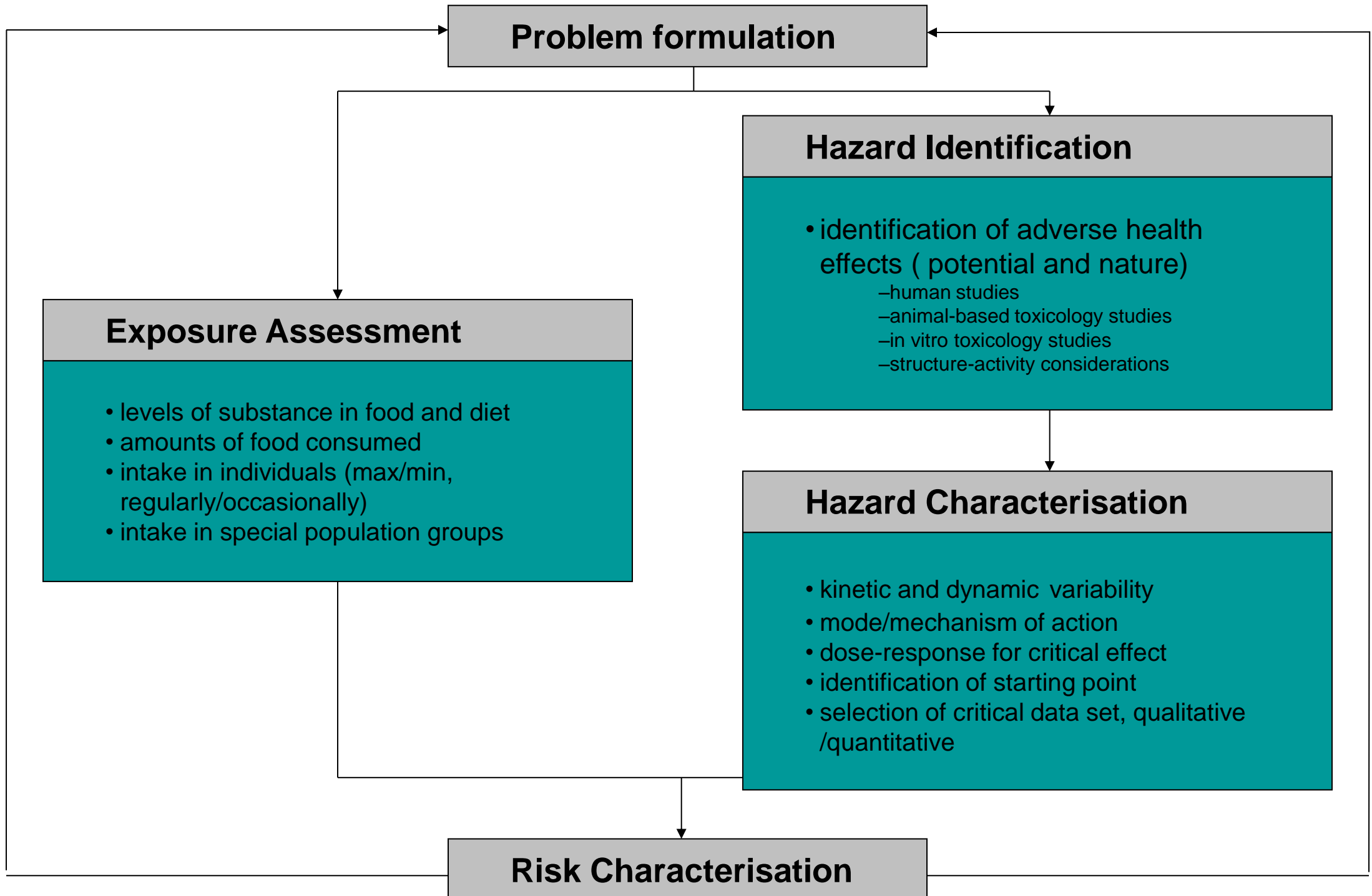
retail

consumer

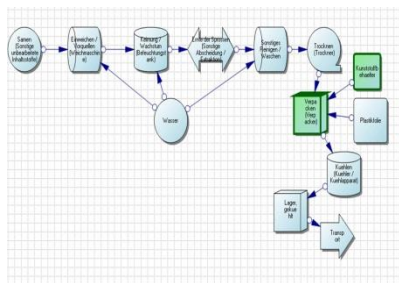


Example: meat production chain

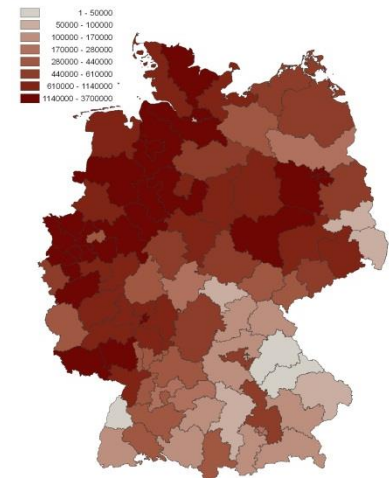
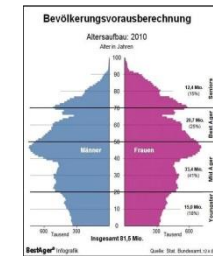
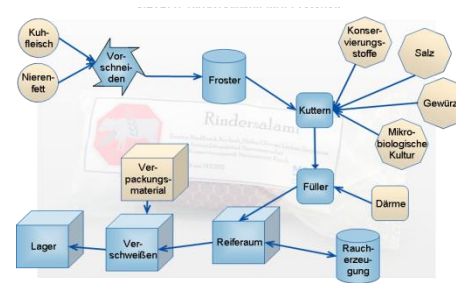
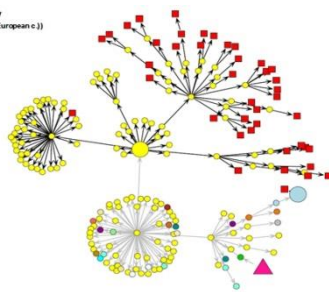
Risk Assessment in global trade: easy to do?



Implications of global food supply chains – Increased complexity of risk / exposure assessments



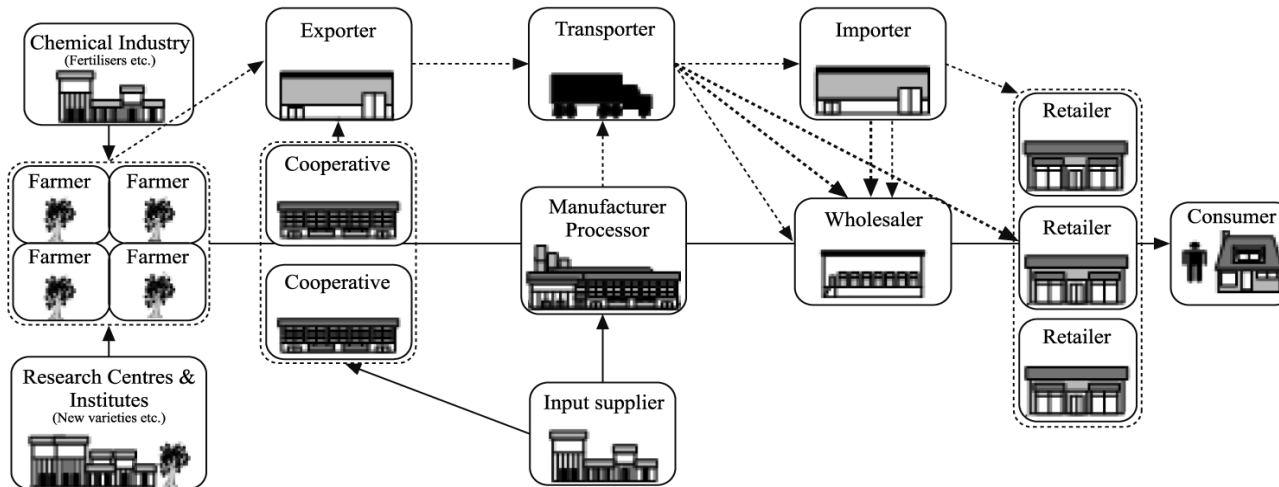
Seed producer, Lower Saxony
Supplier, yellow (GER), other (European c.)
Seed producer
Outbreak cluster
Delivery of sprouts
Delivery of (sprout) seeds



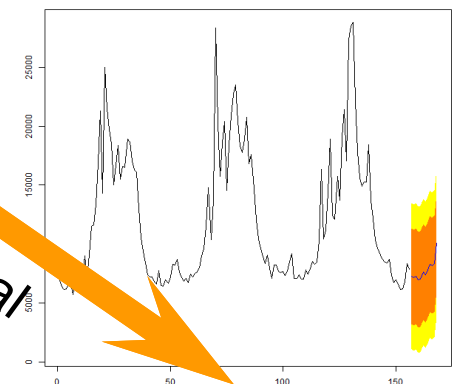
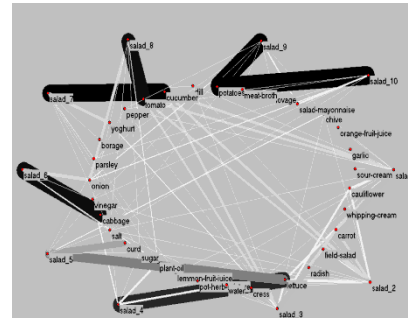
Exposure

Spatial

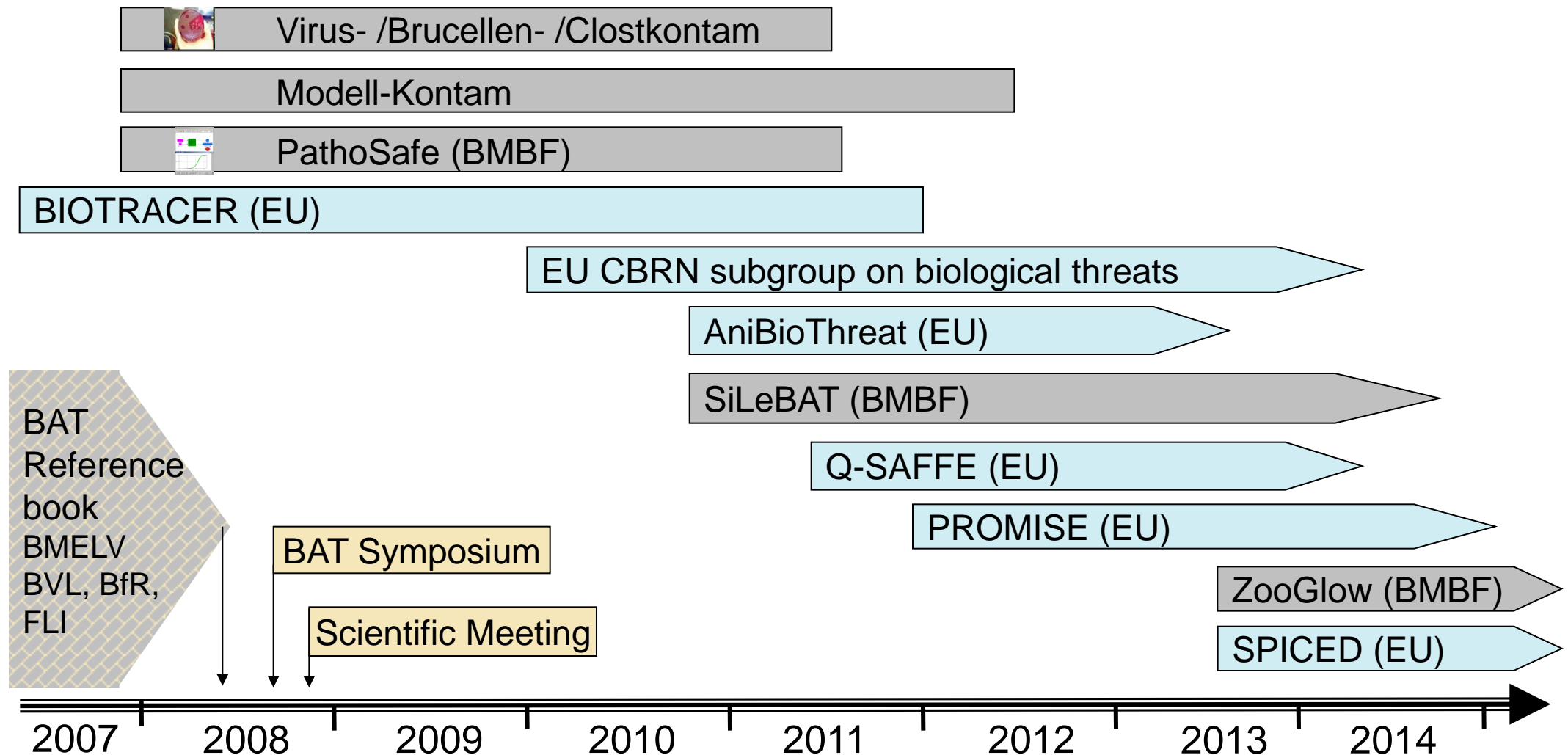
Temporal



186



Bio- and agroterroristic (BAT) Research Initiatives BfR

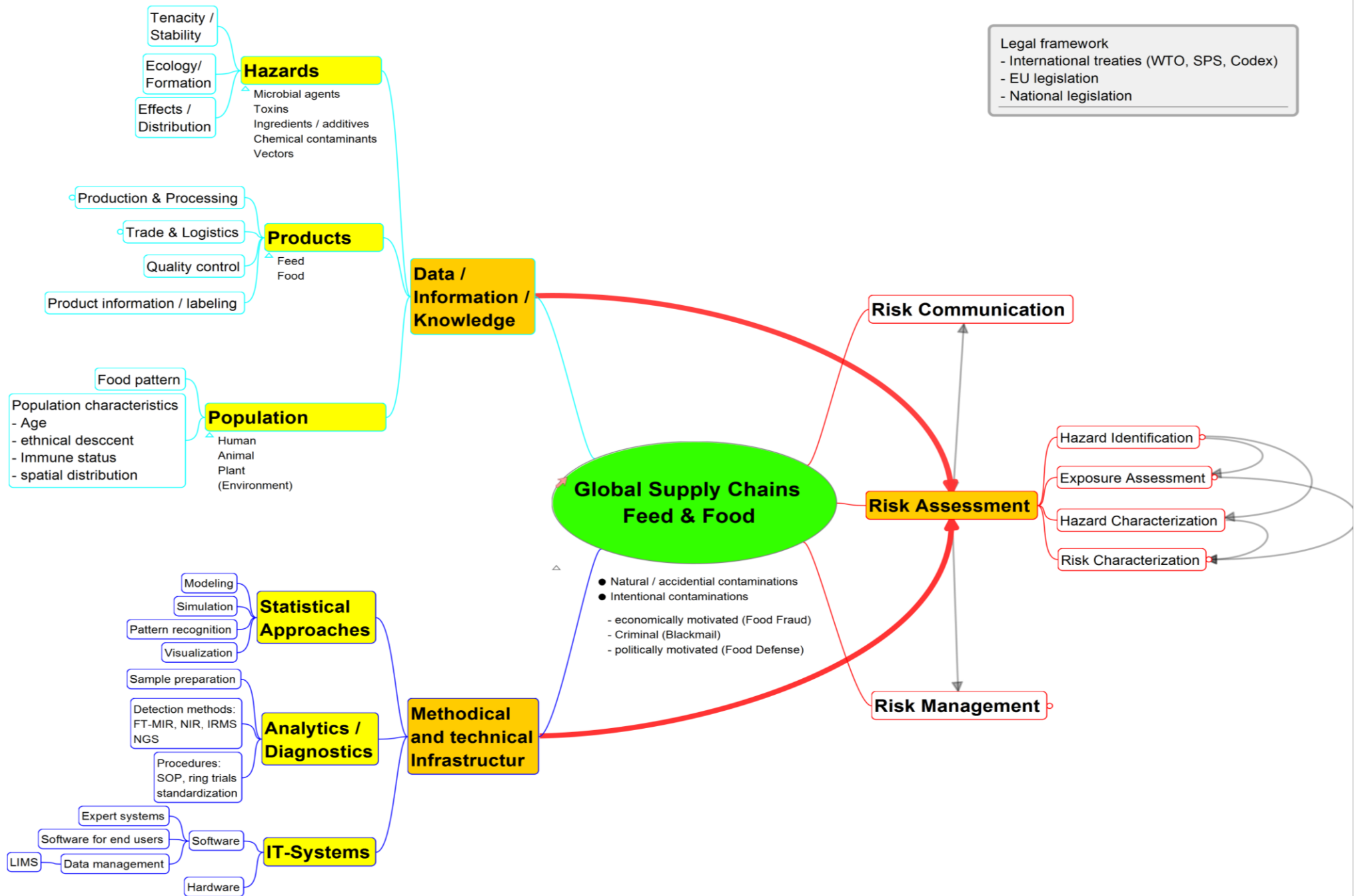


Research Activities on Food Defence

- 7 national projects ranging from 2 to 7 Mio € (2008-2016)
- 5 EU projects 3.0 to 7.5 Mio € (2007-2016)
- further projects on zoonotic agents + antimicrobial resistance

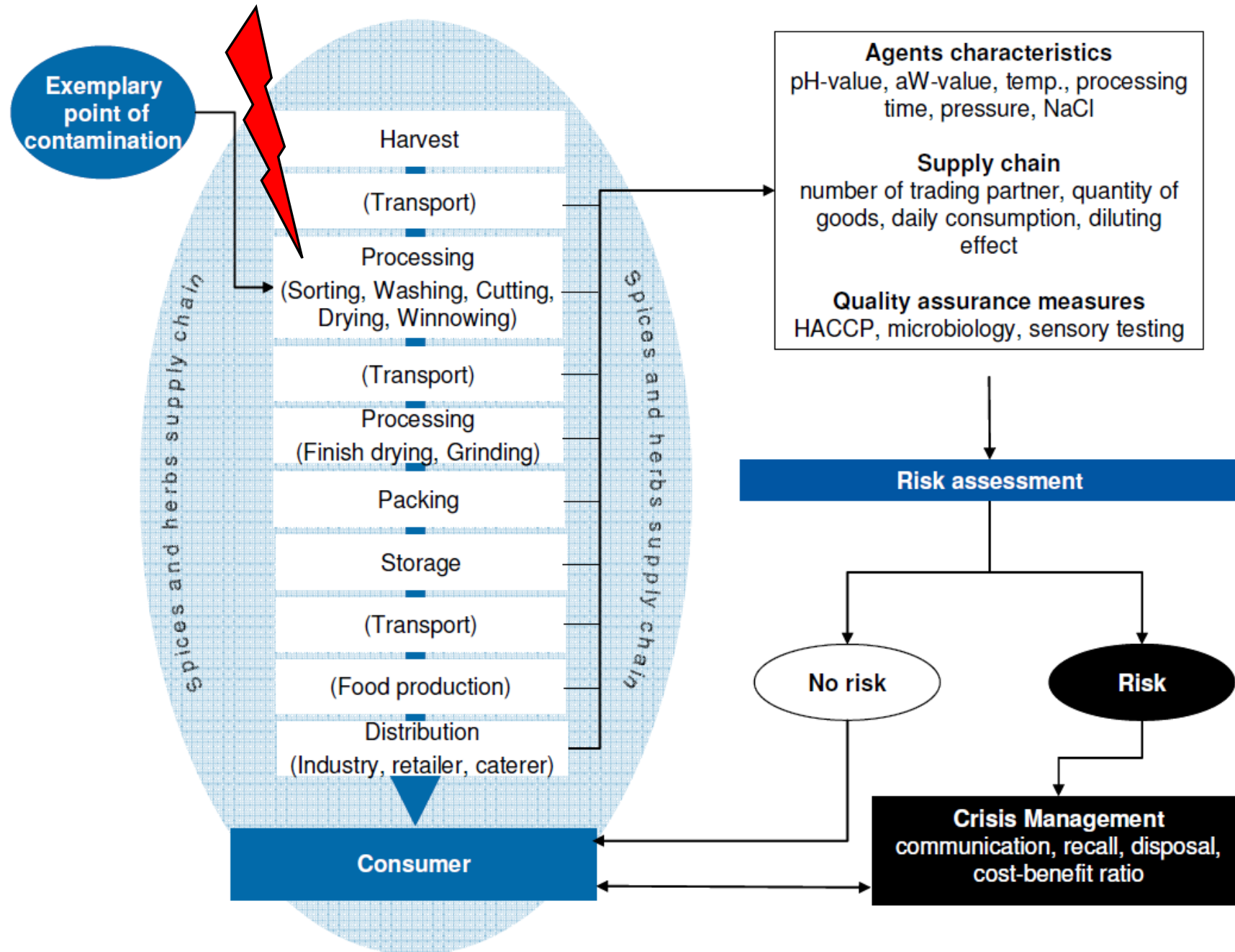
Competence building on food defence with partners: (UK, F, SE, DK, NL, USA, etc.)

Global Supply Chains and Risk Assessment

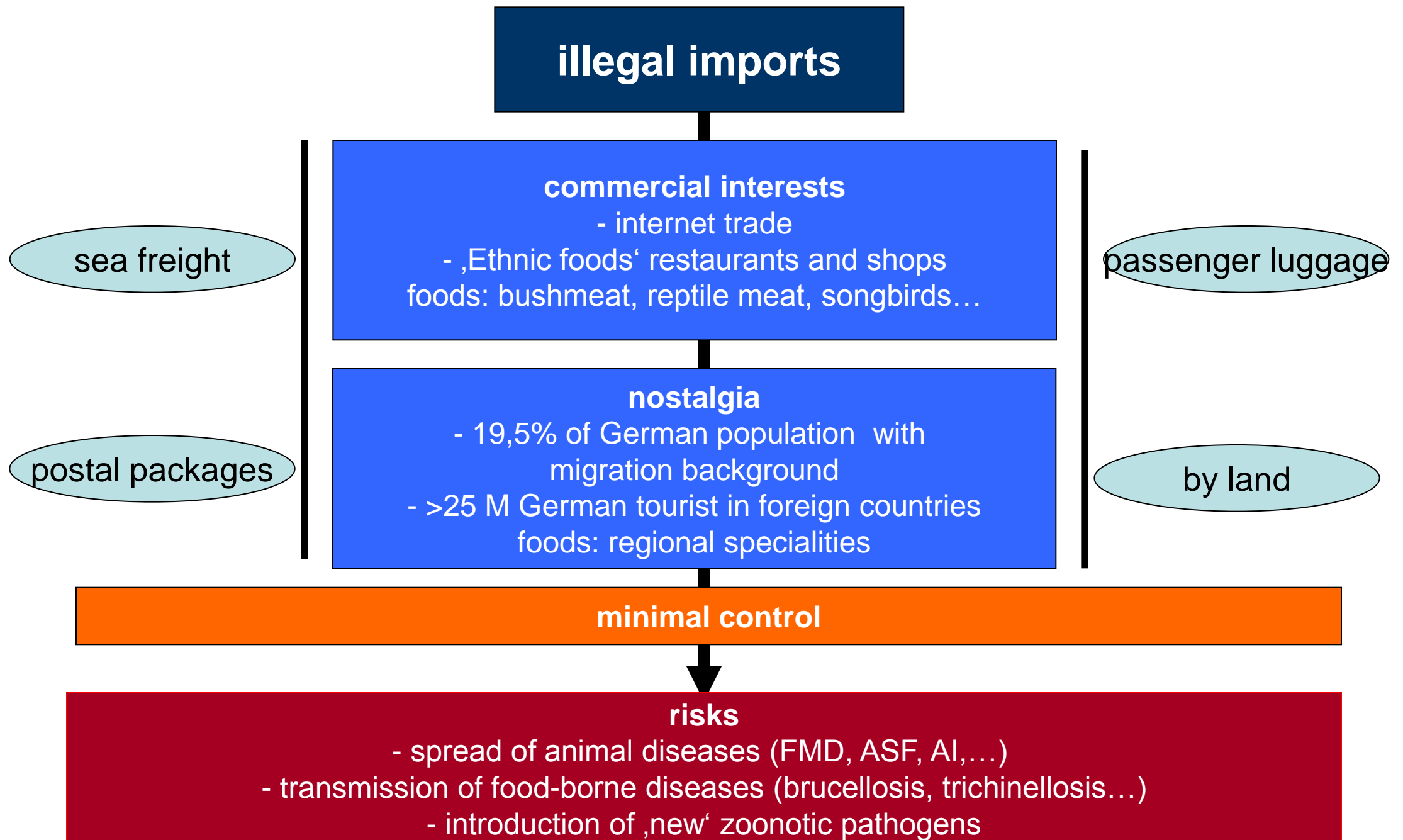




Food Chain – Herbs and Spices



Consequences of globalisation and diversification of consumer behaviour



Confiscated food items



sausage and bacon from Russia



lamb carcass from Tunisia



poultry carcass from Egypt



meat products from Vietnam



meat products and century eggs from China



biltong from South-Africa

Confiscated food items



cheese from Turkey



yoghurt products from
Uzbekistan

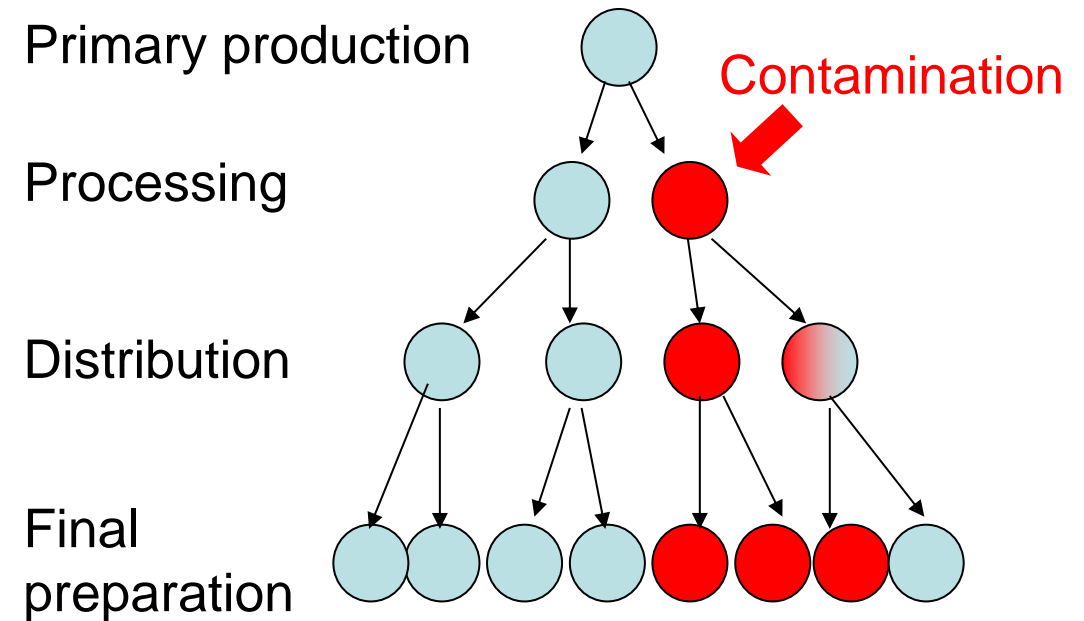
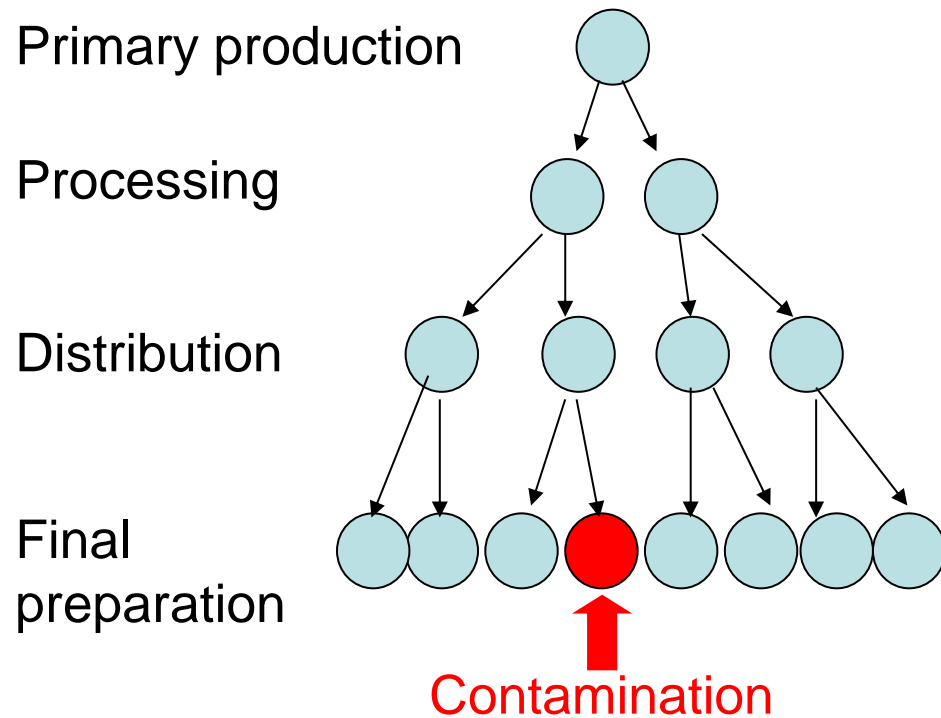
How do we cope with food-borne outbreaks in the context of global food chains?

Outbreaks resulting from contaminations along the food chain

Local foodborne outbreak

vs.

Diffuse foodborne outbreak



Focal

Source of contamination
Contamination dose
Detection
Investigation

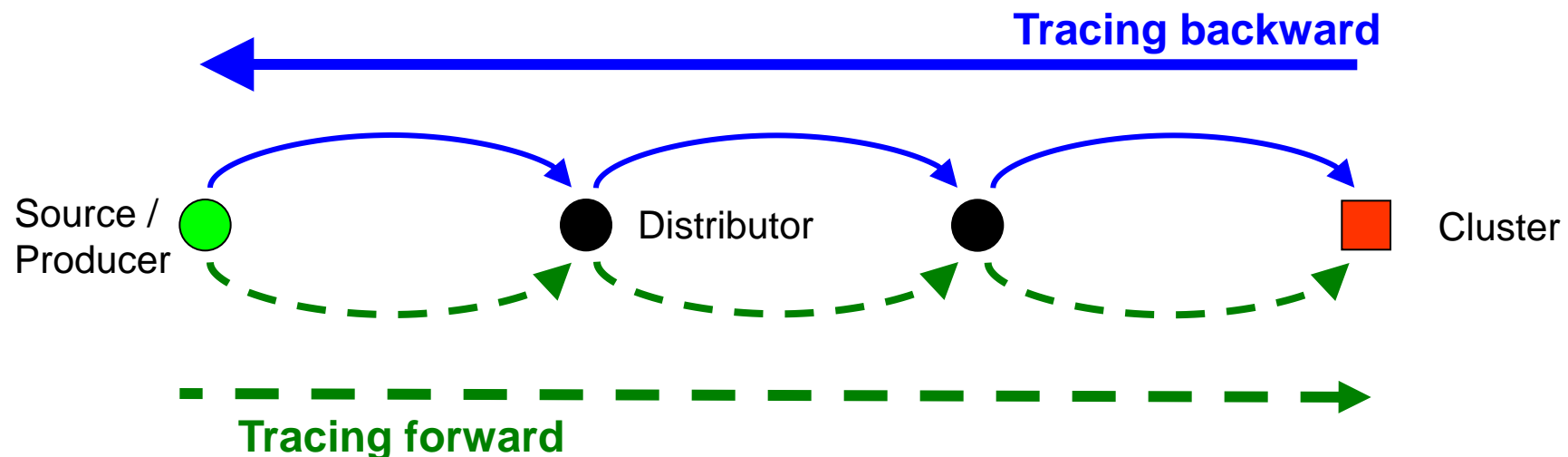
local food handling
high
self-reporting, lab follow-up
local, tracing back

Multifocal or diffuse

at production or processing
low
lab-based subtype surveillance
Complex multistate investigation

Outbreak investigation - methodology

- Identification of „Outbreak-Clusters“
- Supply chain analysis:
 - Tracing backward : Clusters → common Producer / Source
 - Tracing forward: Producer / Source → further Clusters
 - Network analysis
- Risk oriented sampling in factories, further tracing backward/forward



Weiser et al., 2013: "Trace-Back and Trace-Forward Tools Developed Ad Hoc and Used During the STEC O104:H4 Outbreak 2011 in Germany and Generic Concepts for Future Outbreak Situations", **Foodborne Pathog Dis.** 2013.

Example: *E. coli* O104:H4 outbreak, 2011



Largest outbreak by EHEC infection in Germany so far

Cases:	3793 (2353 hospitalized, 53 death)
Setting:	Disseminated cases (restaurants, hotels, canteens, household)
Causative food:	Sprouted fenugreek seeds
Epidemiol. evidence:	Cohort study, trace-back and network analyses (delivery chains of sprouts and seeds)

Example: Norovirus outbreak, 2012

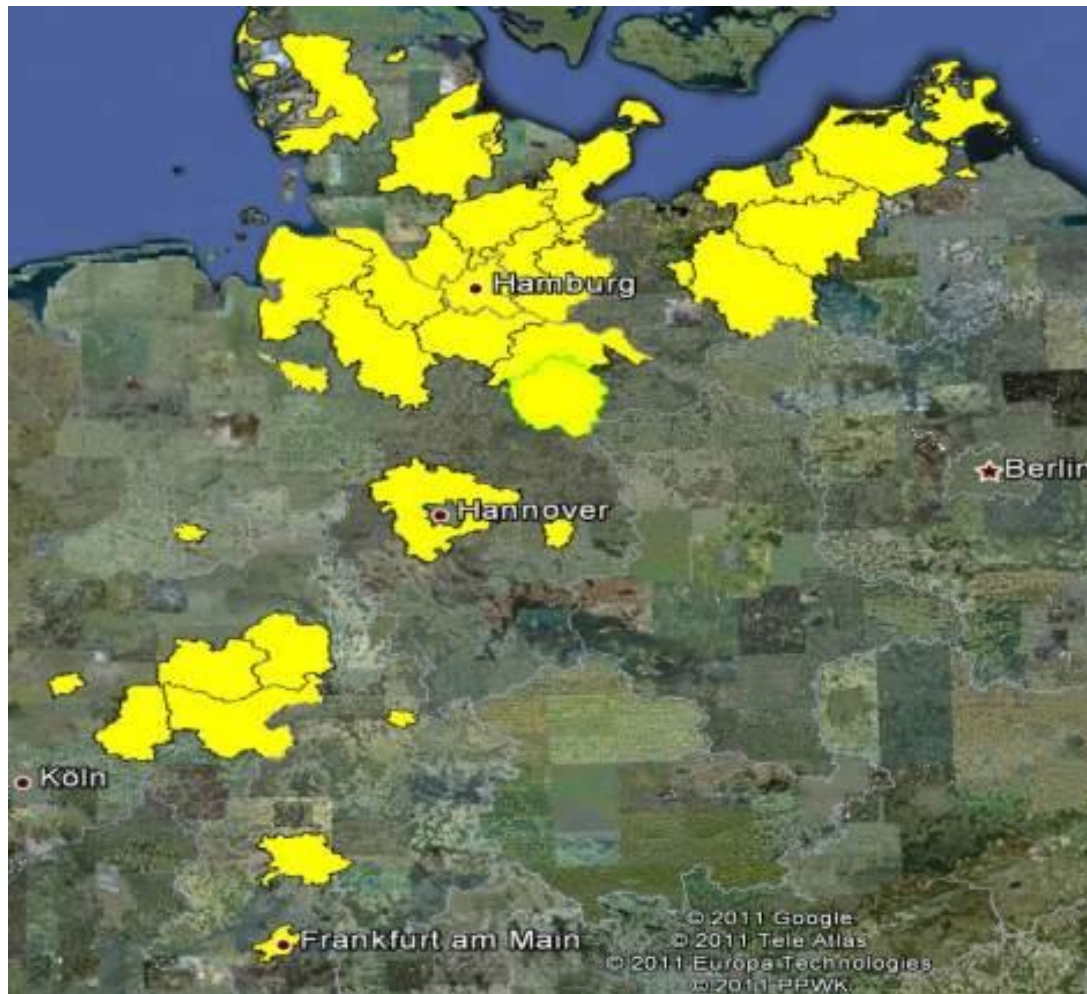


Largest food-borne outbreak in Germany so far

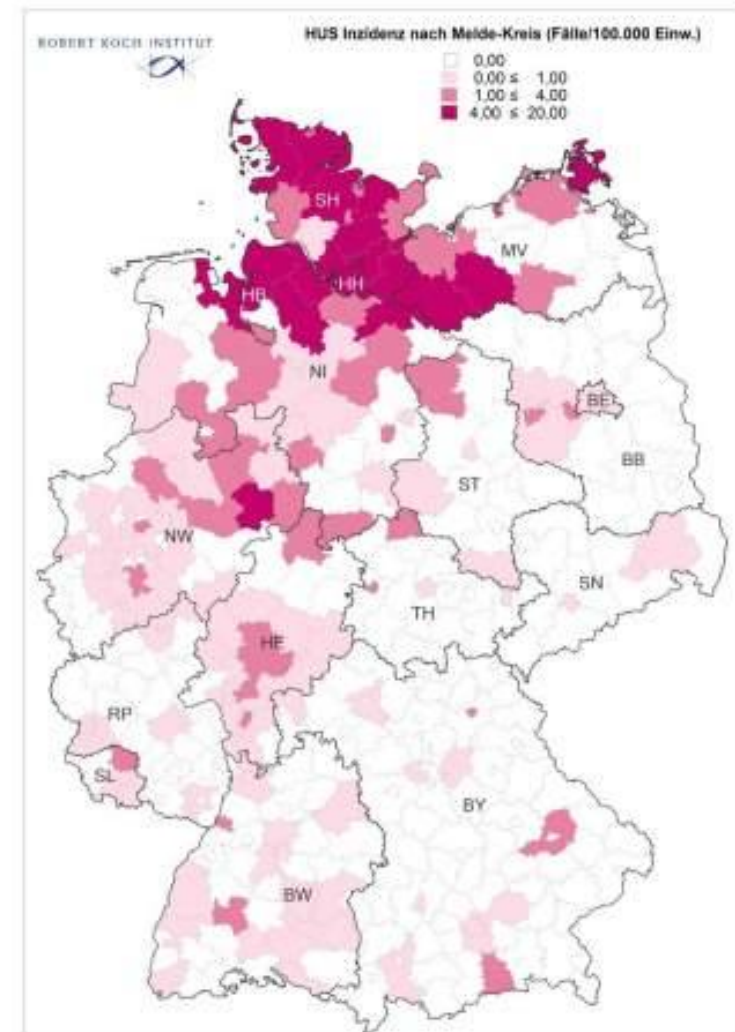
Cases:	10 950 (38 hospitalized)
Setting:	Disseminated cases (at least 390 affected facilities, almost exclusively schools and kindergartens)
Causative food:	Imported frozen strawberries
Epidemiol. evidence:	Case-control studies, trace-back investigations
Microbiol. evidence:	Detection of outbreak strains in the suspected lot of frozen strawberries

Epidemiological survey

Distribution of sprouts from the horticultural farm in lower saxony



Weiser et al., 2013: "Trace-Back and Trace-Forward Tools Developed Ad Hoc and Used During the STEC O104:H4 Outbreak 2011 in Germany and Generic Concepts for Future Outbreak Situations", *Foodborne Pathog Dis.* 2013.



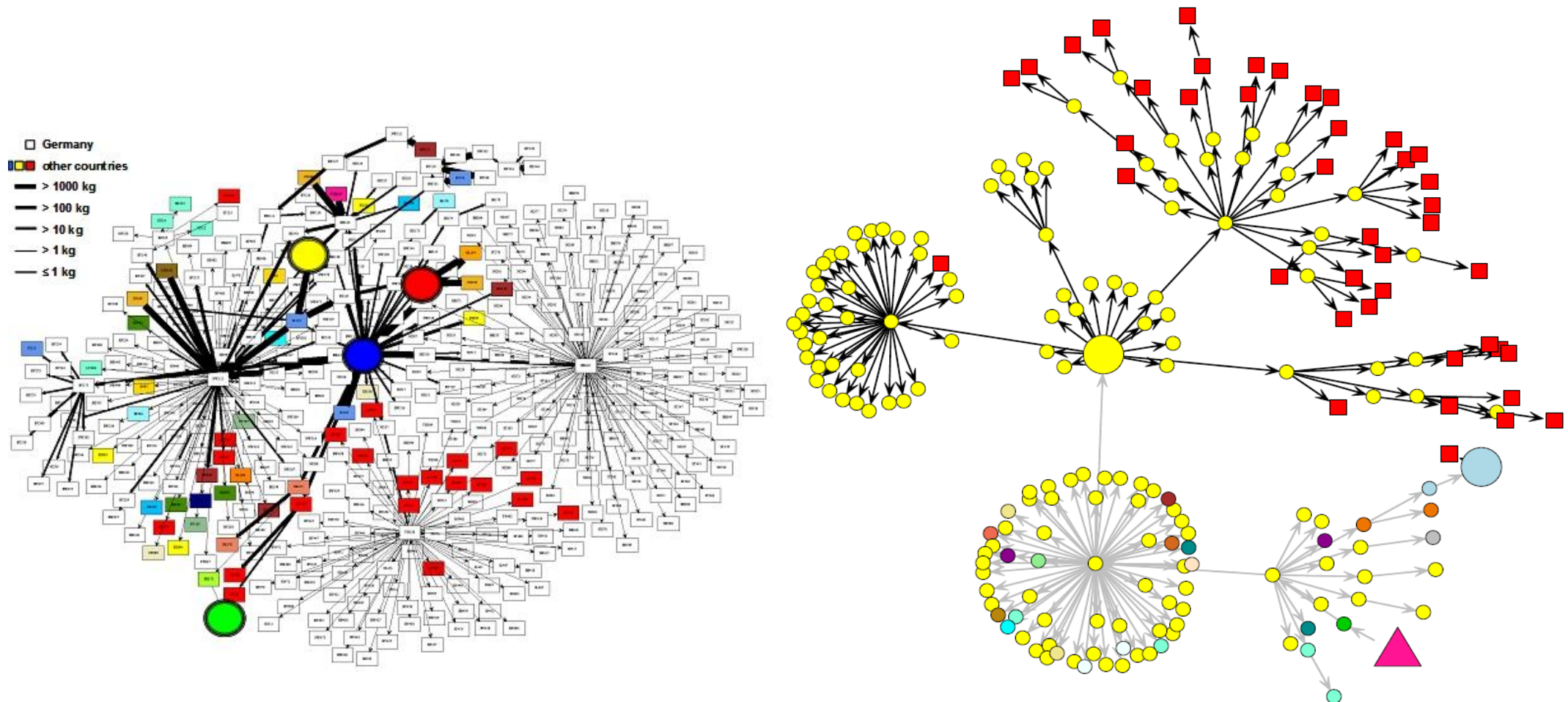
HUS incidences by residence

(per 100.000 inhabitants)

Robert Koch-Institute (data 13 July 11)

Example: *E. coli* O104:H4 outbreak, 2011

Distribution of fenugreek seeds from Egypt (Batch 48088, 15 t)

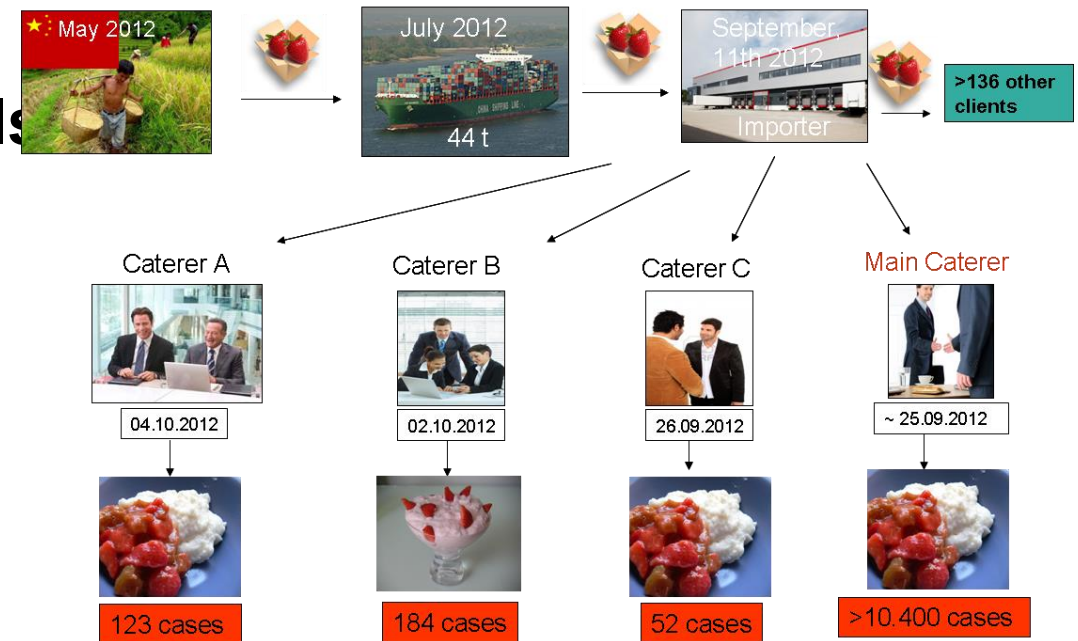


Weiser et al., 2013: “Trace-Back and Trace-Forward Tools Developed Ad Hoc and Used During the STEC O104:H4 Outbreak 2011 in Germany and Generic Concepts for Future Outbreak Situations“, **Foodborne Pathog Dis.** 2013.

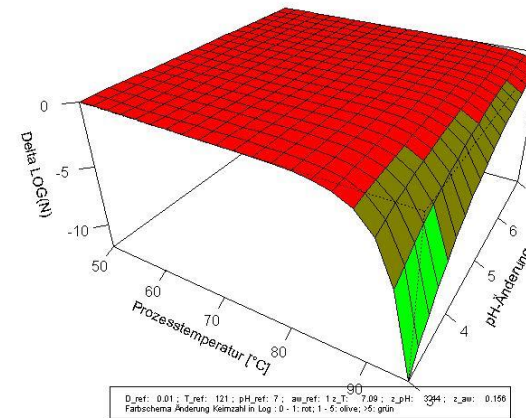
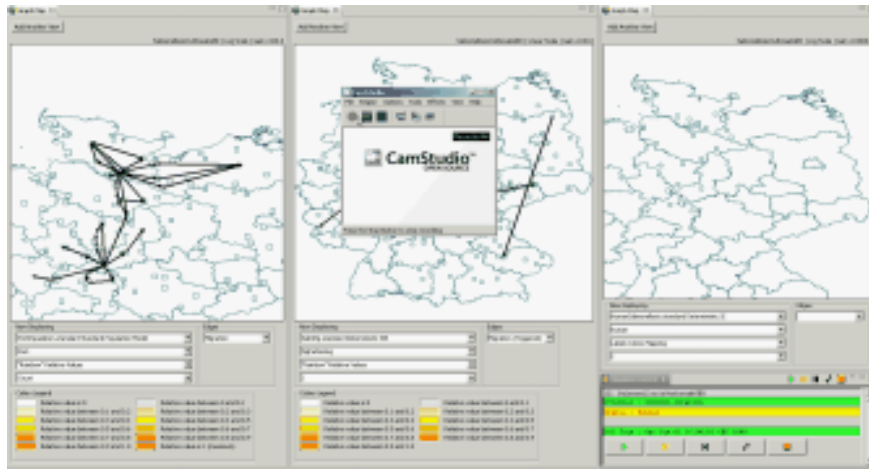
Real world examples:

Norovirus outbreak 2012

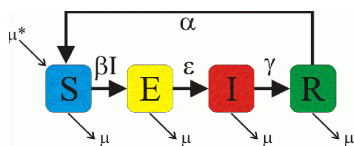
- A total of **10.950 cases**, averagely 10 years old
- At least **390 affected facilities (cluster)**, almost exclusively schools and kindergartens
- Associated to one main catering company and some minor ones



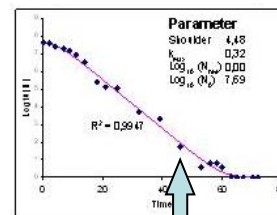
Our Vision and Invitation: Join the development of food safety community tools + community databases



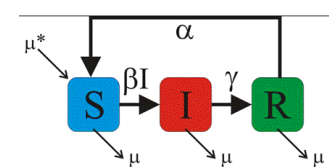
animal disease
models



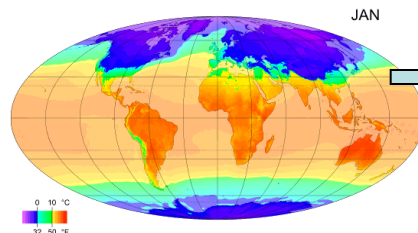
Food processing and distribution



human disease
models



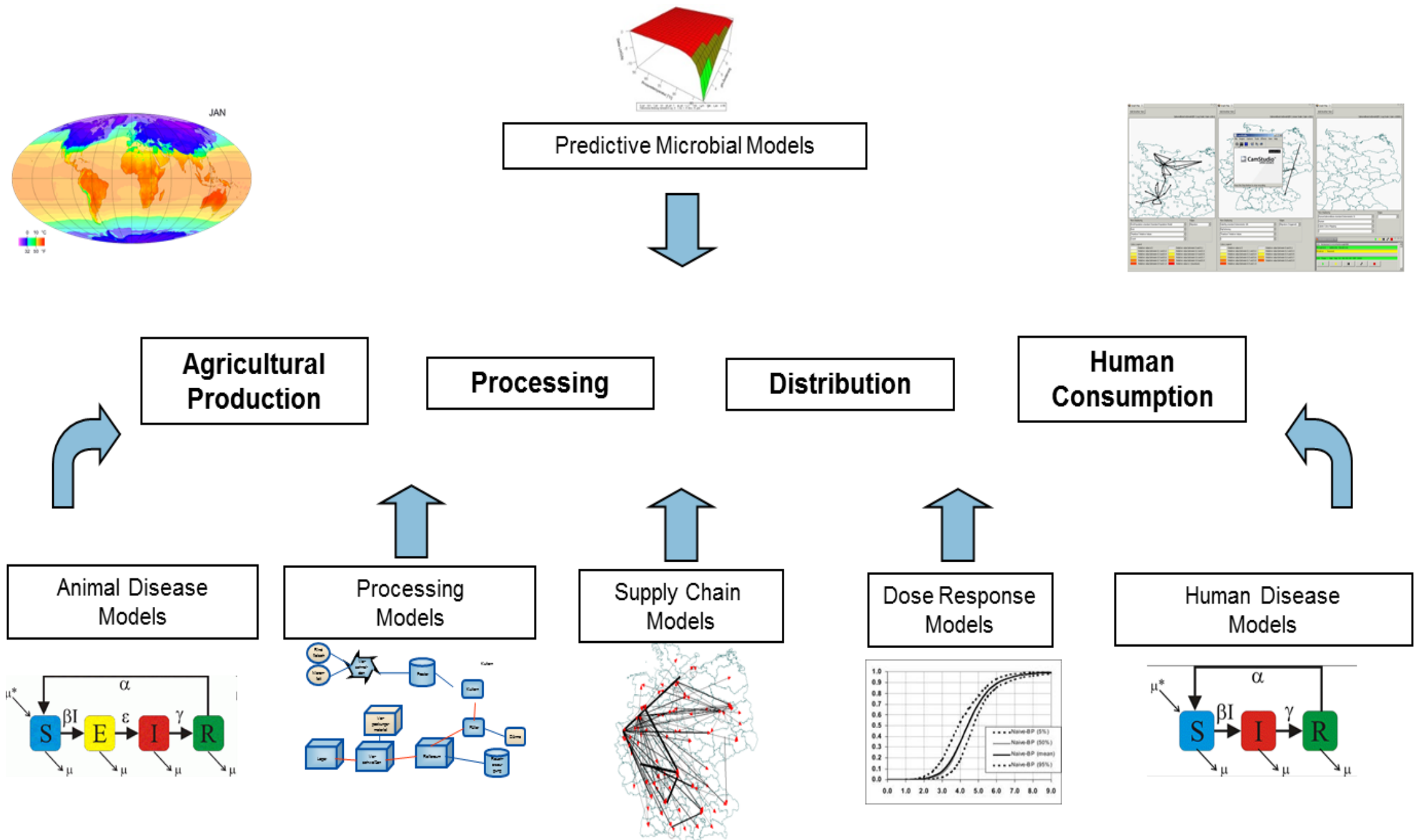
Environmental factors



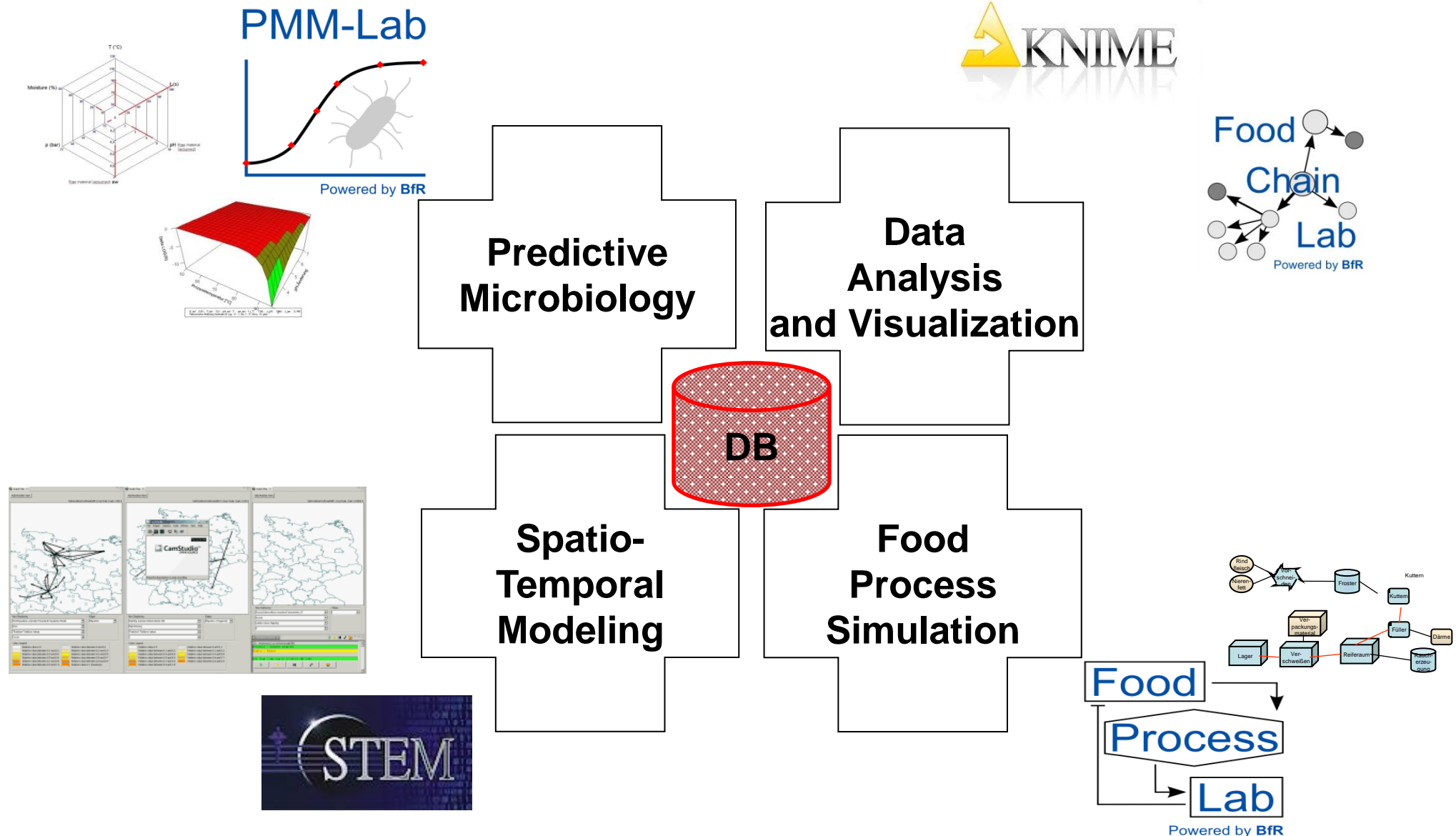
Processing parameters



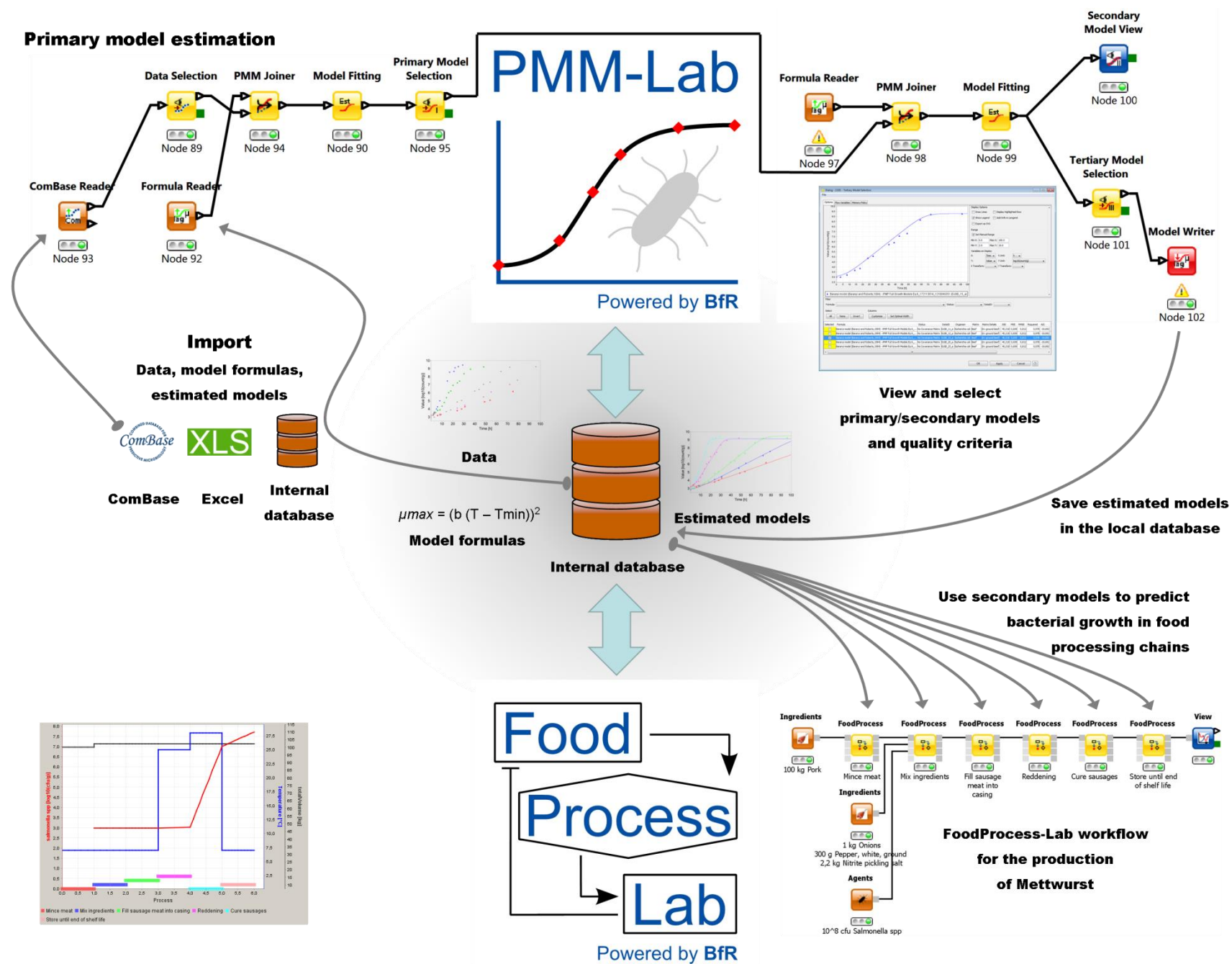
Model-based Solutions Supporting Risk Assessments in Crisis Situations



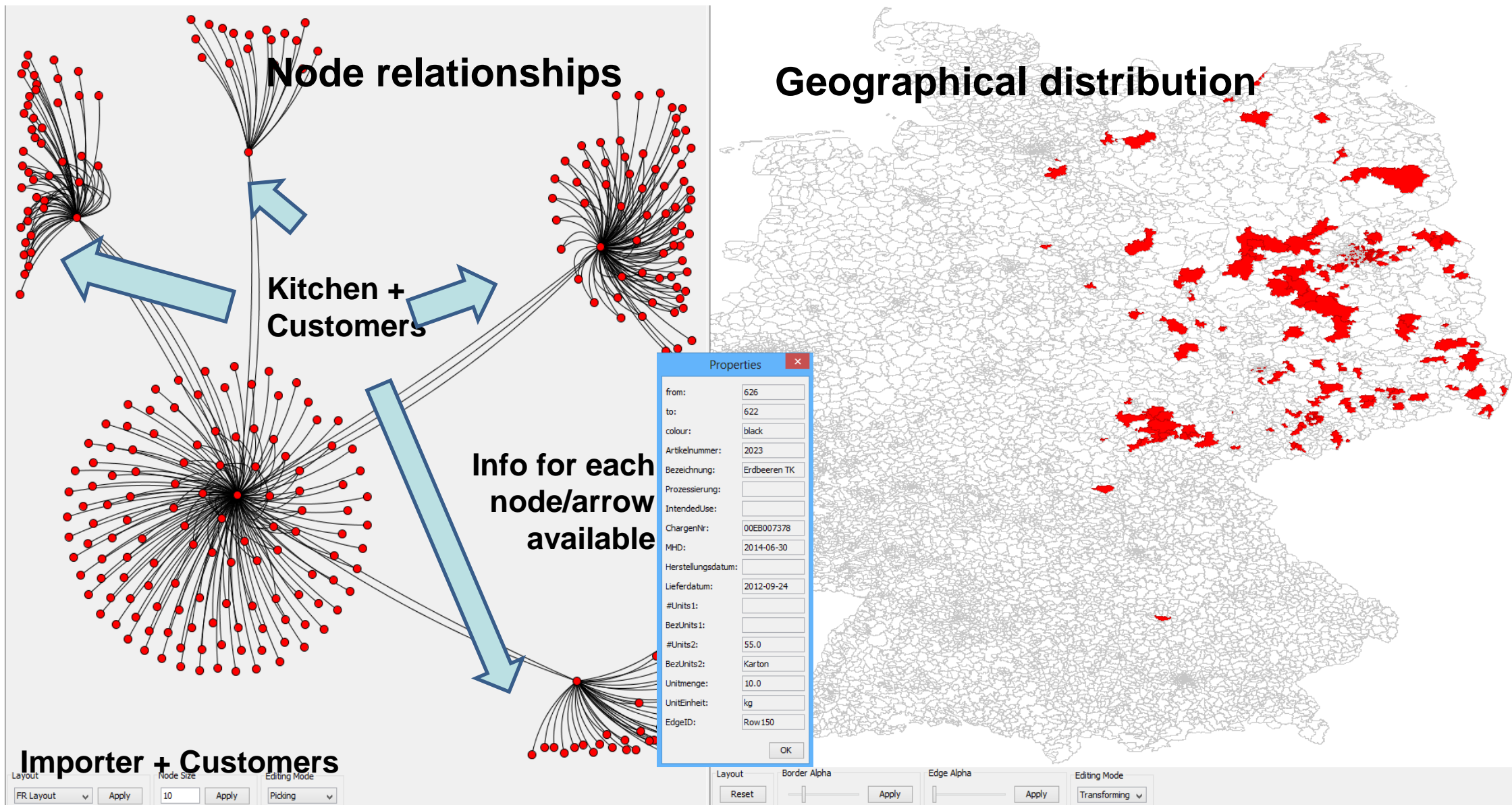
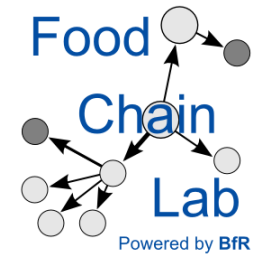
Solution – Development of community tools / models for risk / exposure assessment (and beyond)



PMM-Lab und FoodProcess-Lab



Example: FoodChain-Lab on Outbreak data: Norovirus 2012



powered by BfR; SiLeBAT – Project, BMBF- research grant 13N11202

What is KNIME ?



- KNIME = Konstanz Information Miner
- Open-Source PC-Software (www.knime.org)
- “Community”
- “powerfull” Tool for data analysis
- **modulare System**

