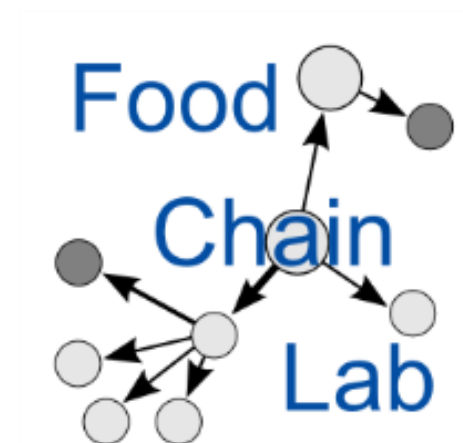
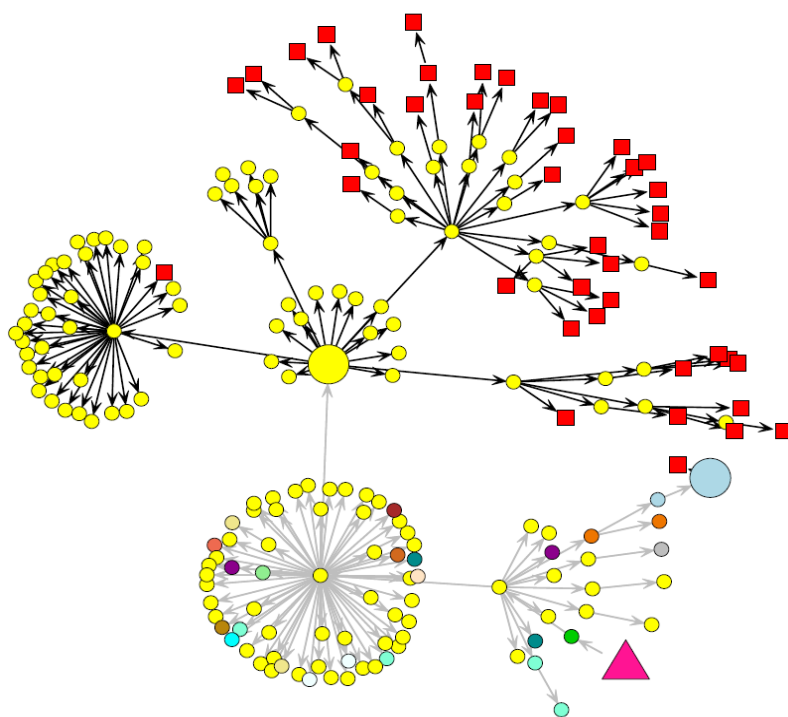


Introduction to FoodChain-Lab

Schematization and Visualization of Food Chains

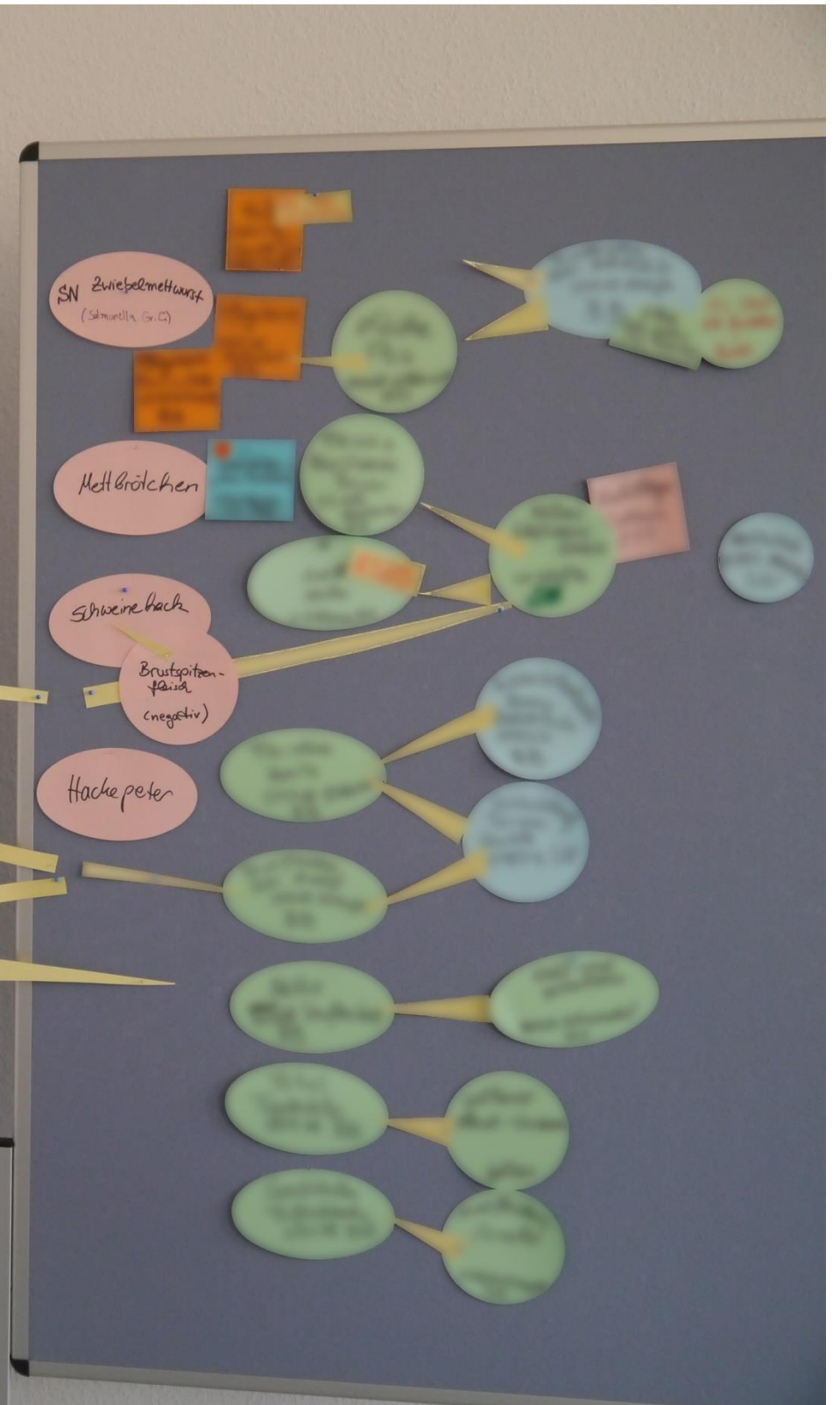
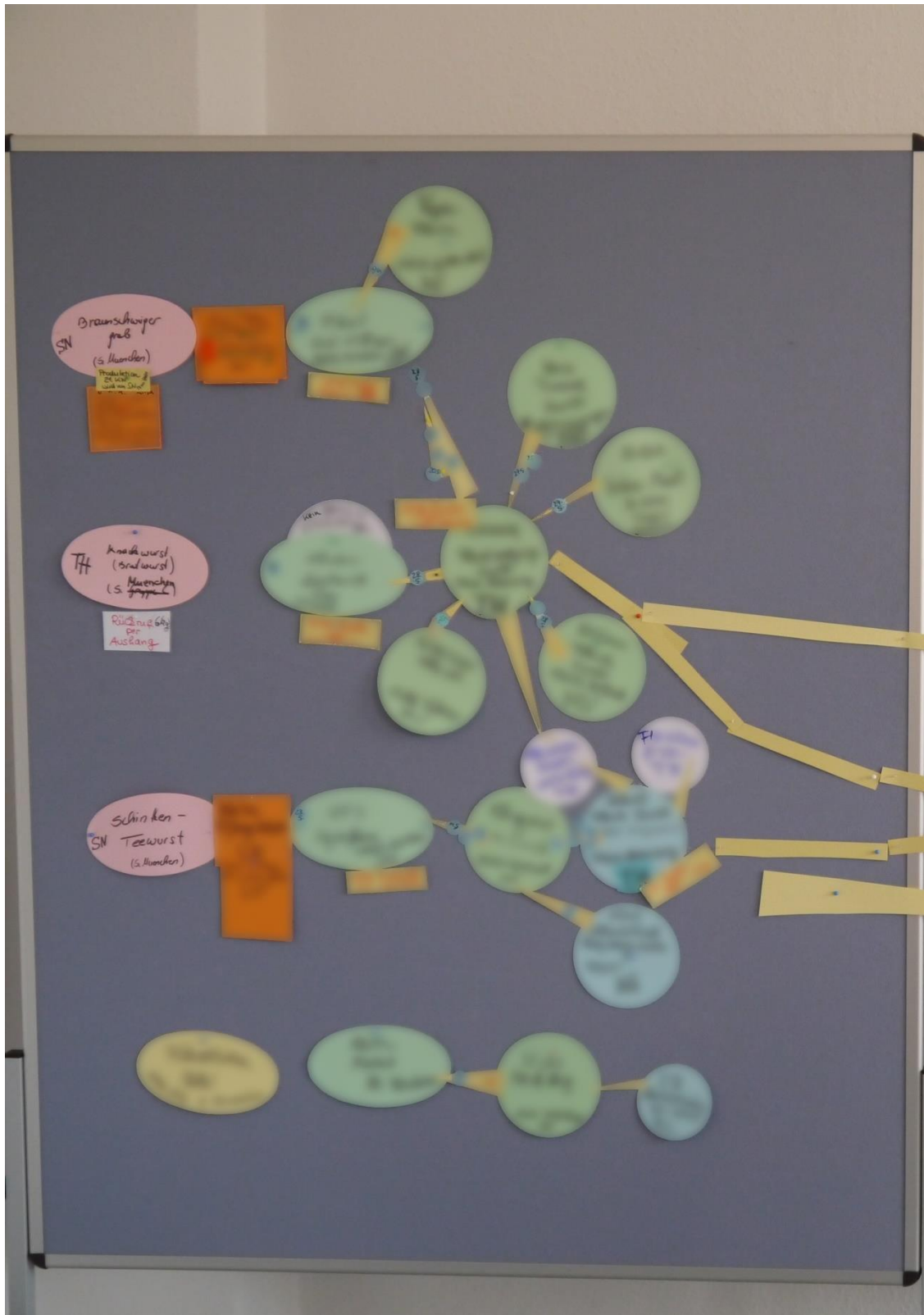


**Armin Weiser, Christian Thöns, Alexander Falenski,
Matthias Filter, Annemarie Käsbohrer, Bernd Appel**

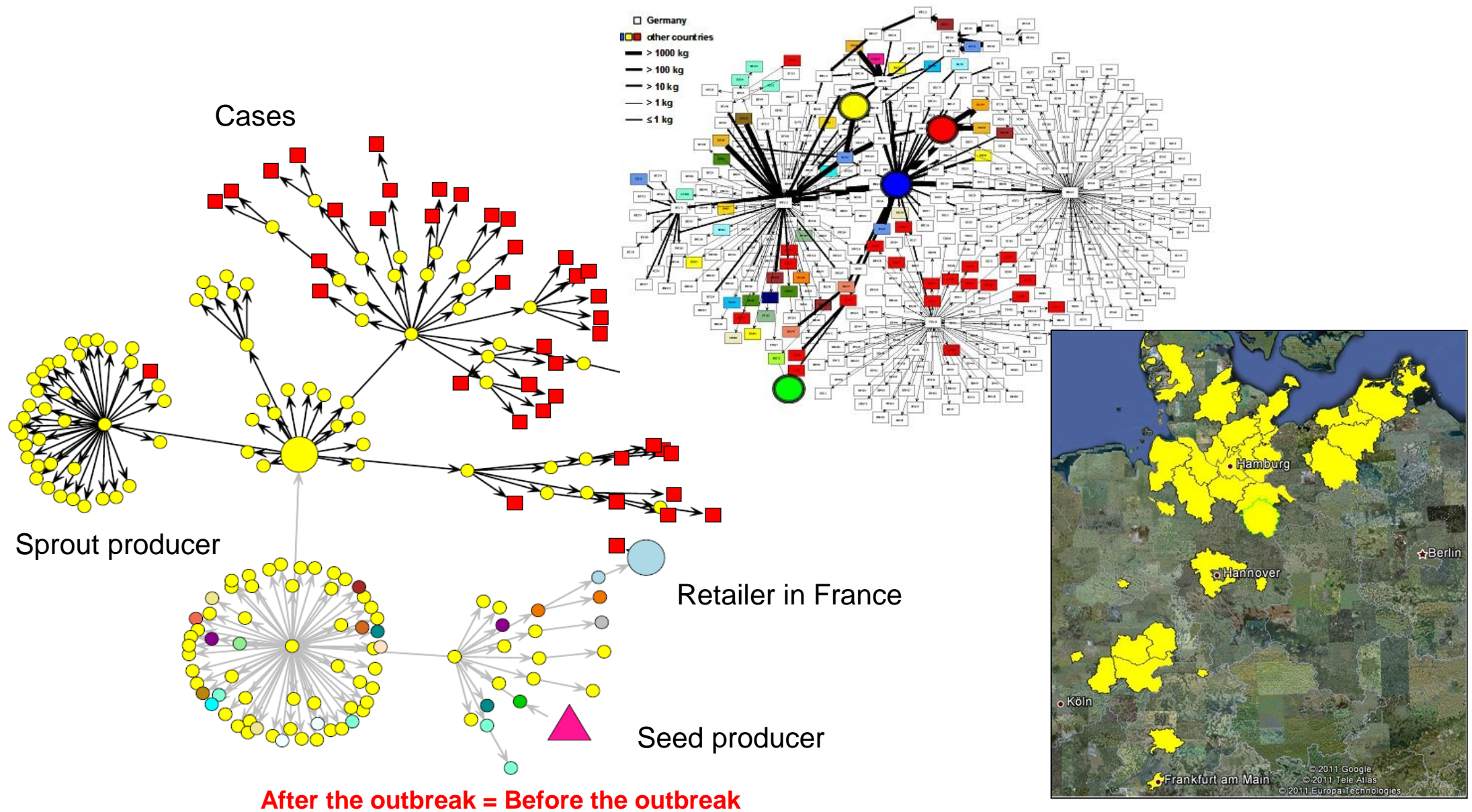
Aims of the Workshop

- FoodChain-Lab
 - Analysis & Visualisation
- Data Collection & Validation
 - Smooth/straight forward/best practice data collection
 - Detection of plausibility issues / similarities
 - Exchange of experiences
- Redistribution of FCL
 - Application of FCL on historical and new outbreaks
(autonomously or at first supported by BfR/EFSA)
- Perspectives of FoodChain-Lab and Tracing in general
- Come together

FoodChain-Lab – Why did we do it?



FoodChain-Lab – ad hoc



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.

Weiser et al., 2016: “FoodChain-Lab: a trace-back and trace-forward tool developed and applied during food-borne disease outbreak investigations in Germany and Europe”, **PLoS ONE**.



Integration of scientific solutions for

Prevention & Limitation of damage

Risikobewertungen (zeitnah und fundiert)

Probenvorbereitungs- und Nachweisverfahren

Handlungsempfehlungen

Kosten-Nutzen-Analysen

Einschätzung
der Gefährdungslage

Spezifische Verfahren
zur Früherkennung

Vulnerabilität von Warenströmen

Schulung, Übungen, Beratung

Wissen über Agenzien
(Verhalten, Gefährdungspotential)

Supply Chains and its structures

Optimale Interventionspunkte

Entsorgung, Dekontamination

Freigabe von Produkten

FoodChain-Lab

Past events



19 – 20 March 2015, Berlin Germany

FoodChain-Lab - An innovative tool for food safety through product chain analyzes

12 – 13 May 2015, Bern, Switzerland

Introduction to the FoodChain-Lab software - an innovative tool for food safety through product chain analysis

12 – 13 November 2015, Berlin Germany

International FoodChain-Lab Workshop 2015

8 – 9 February 2016, Berlin Germany

HoA workshop: Tools supporting food chain safety assessments

15 – 17 March 2016, Riga, Latvia

Baltic Countries 2016 Workshop on Crisis preparedness

2016/2017, NRW, Germany

Linking FoodChain-Lab to the regional tracing database



Framework Partnership Agreement

EFSA and BfR to work jointly on global food safety tools

Title: Risk Assessment Tools for the Safety of Global Food and Feed Supply Chains (Number: GP/EFSA/AMU/2016/01)

- ED visit to Germany on 30th October 2014
- Framework Partnership Agreement, signed on 8th December 2016

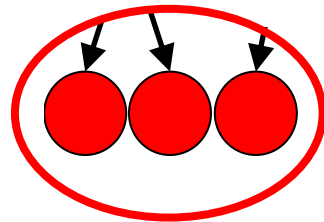


- Description: Trace-back and predictive modelling tools for use during food safety outbreaks and created by scientific teams led by the German Federal Institute for Risk Assessment (BfR) will be further rolled out under a new funding partnership agreed between EFSA and BfR. The two agencies will be able to further benefit from each other's research efforts and avoid duplication of future work programmes.
- Life span: 4 years
- Press releases: <https://www.efsa.europa.eu/en/press/news/161208>
<http://www.bfr.bund.de/cm/349/efsa-and-bfr-to-work-jointly-on-global-food-safety-tools.pdf>

Szenario:


Überregionaler (diffuser) Ausbruch

- Kontamination bei der Produktion/Verarbeitung
- Diffuse Verteilung der Fälle
- Niedrige Dosis
- Niedrige Erkrankungsrate
- Komplexe Untersuchung



Das Ausbruch
Untersuchungsteam sieht
nur **Krankheitsfälle**

REGULATION (EC) No 178/2002, Article 18, Traceability


- 
- (1) The **traceability** of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed shall be established **at all stages of production, processing** and **distribution**.



- (2) **Food and feed business operators** shall be able to identify any person **from** whom they have been supplied with a food, a feed, a food-producing animal, or any substance intended to be, or expected to be, incorporated into a food or feed.

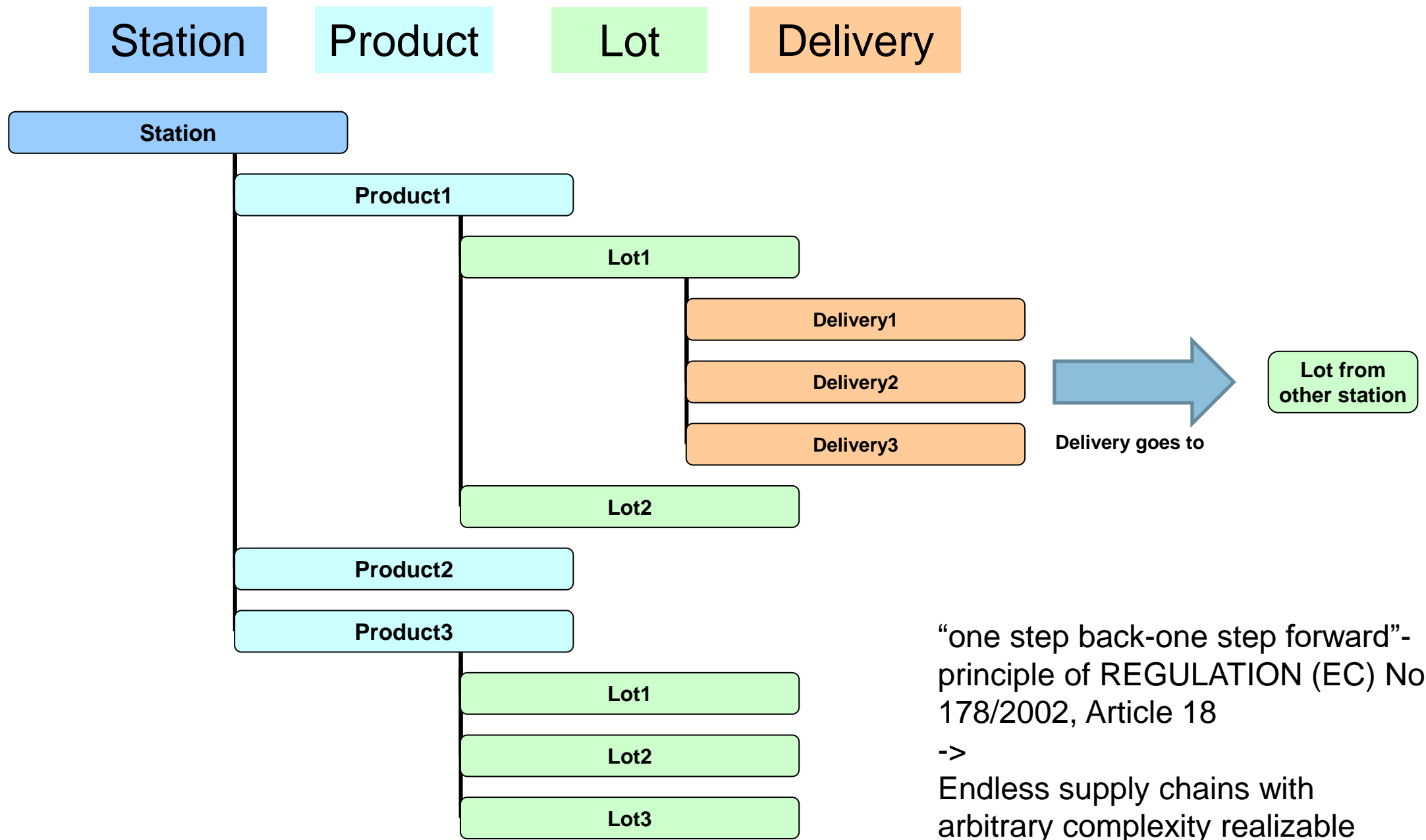


To this end, such operators shall have in place systems and procedures which allow for this information to be made available to the competent authorities **on demand**.

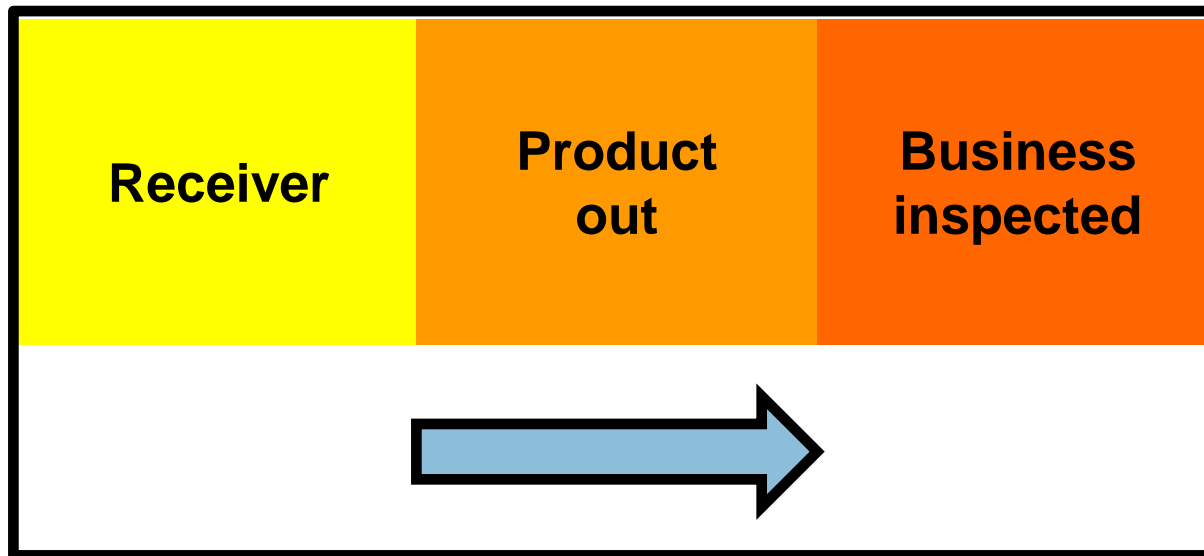
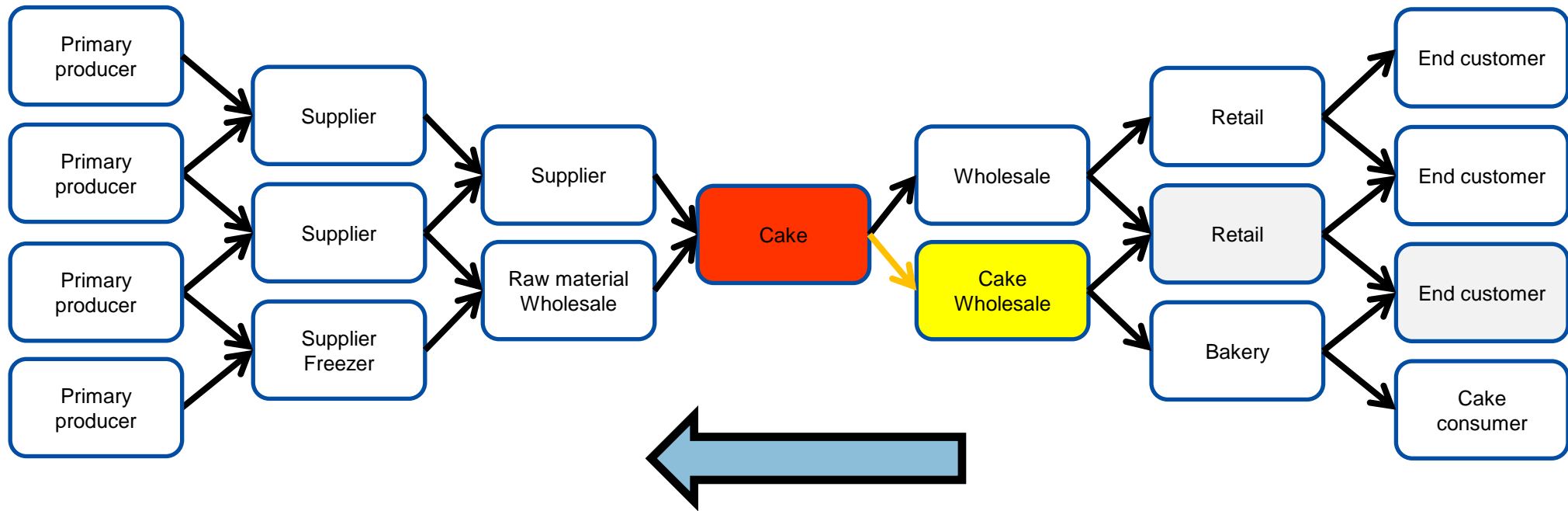
- 
- (3) **Food and feed business operators** shall have in place systems and procedures to identify the other businesses **to** which their products have been supplied. This information shall be made available to the competent authorities **on demand**.



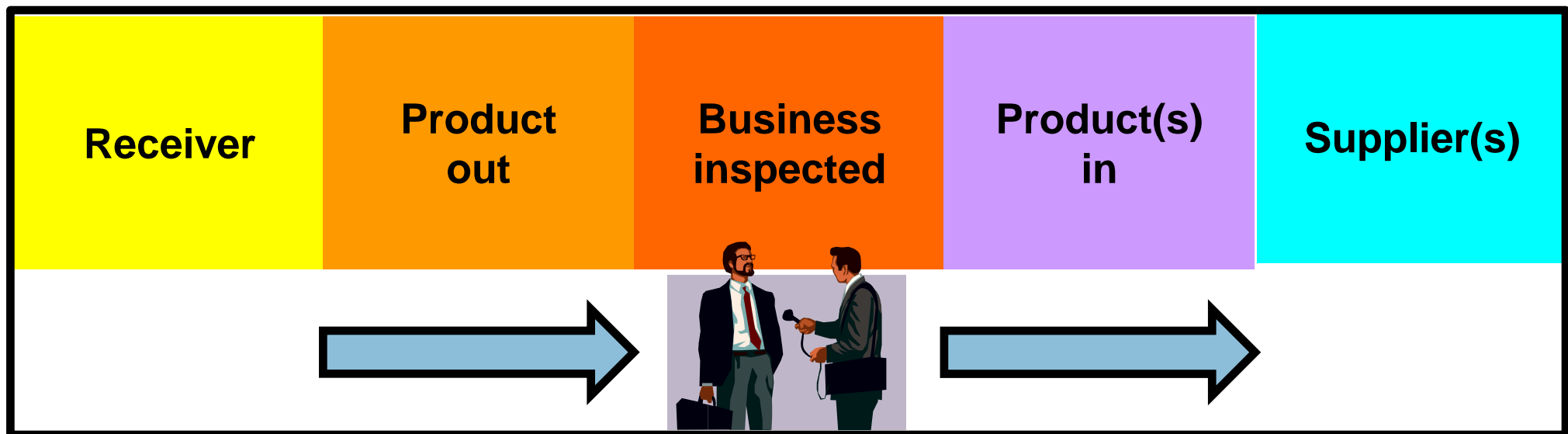
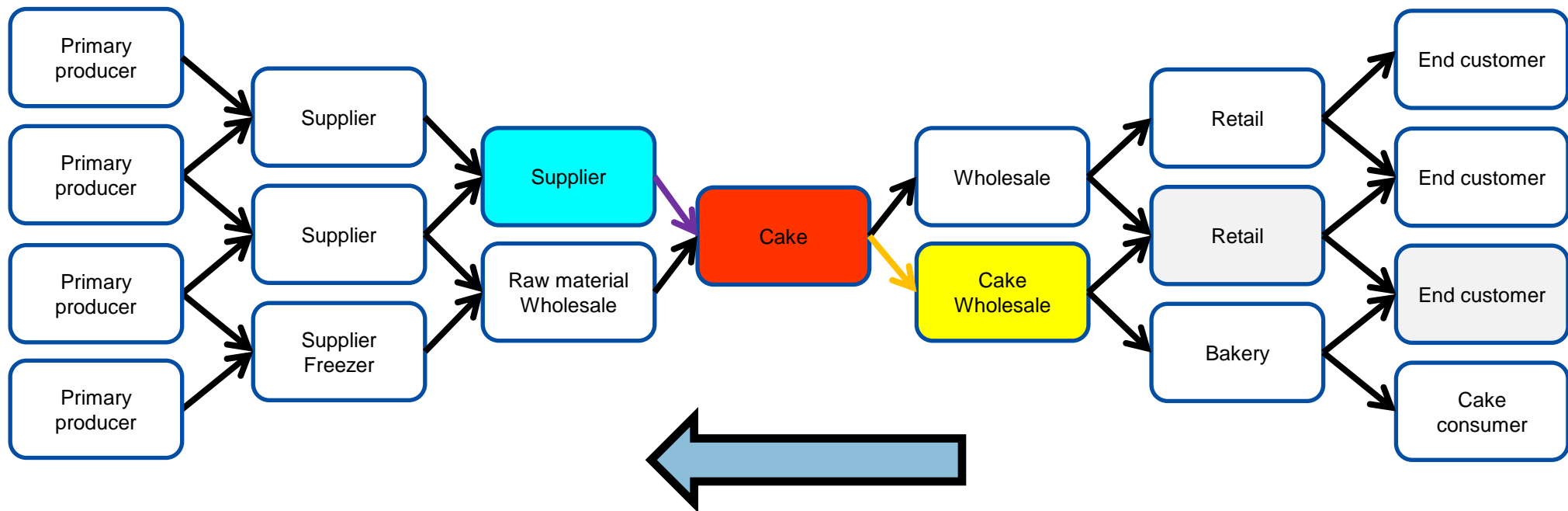
Database – Structure for Food Chains



Principle of tracing back – Data gathering



Principle of tracing back – Data gathering



Data gathering – Development of a new “simple” template

old:

“one step back-one step forward”- principle of REGULATION (EC) No 178/2002, Article 18

->

Endless supply chains with arbitrary complexity realizable

new:

Backtrace_request_3001_Caterer 01.xlsx - Microsoft Excel

DateiStartEinfügen

SeitenlayoutFormelnDatenÜberprüfenAnsicht

E30fx

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Reporter Information												
2	Reporting Officer	Reporting Date	Reporting Remark										
3													
4													
5	Station in Focus:	3001	Caterer 01										
6													
7	Products Out												
8	Product Name	Lot Number	Delivery Date Departure			Delivery Date Arrival			Unit weight/vol./pck.		Recipient		
9			Day	Month	Year	Day	Month	Year	Quantity	Type / Unit			
10	Menü 1	M01	3	9	2014	3	9	2014	62	Portionen	9012		
11	Menü 2	M02	3	9	2014	3	9	2014	101	Portionen	9008		
12													
13	Lot Information												
14	Lot Number of "Product Out"	Lot size											
15		Quantity	Type / Unit										
16	M01	900	Portionen										
17	M02	900	Portionen										
18													
19	Ingredients for Lot(s)												
20	Ingredient Name	Lot Number of Ingredient	Delivery Date Departure			Delivery Date Arrival (if departure unknown)			Unit weight/vol./pck.		Supplier		
21			Day	Month	Year	Day	Month	Year	Quantity	Type / Unit			
22													
23													
24													

StationsBackTracingForwardTracing_OptLookUpHelp

Bereit

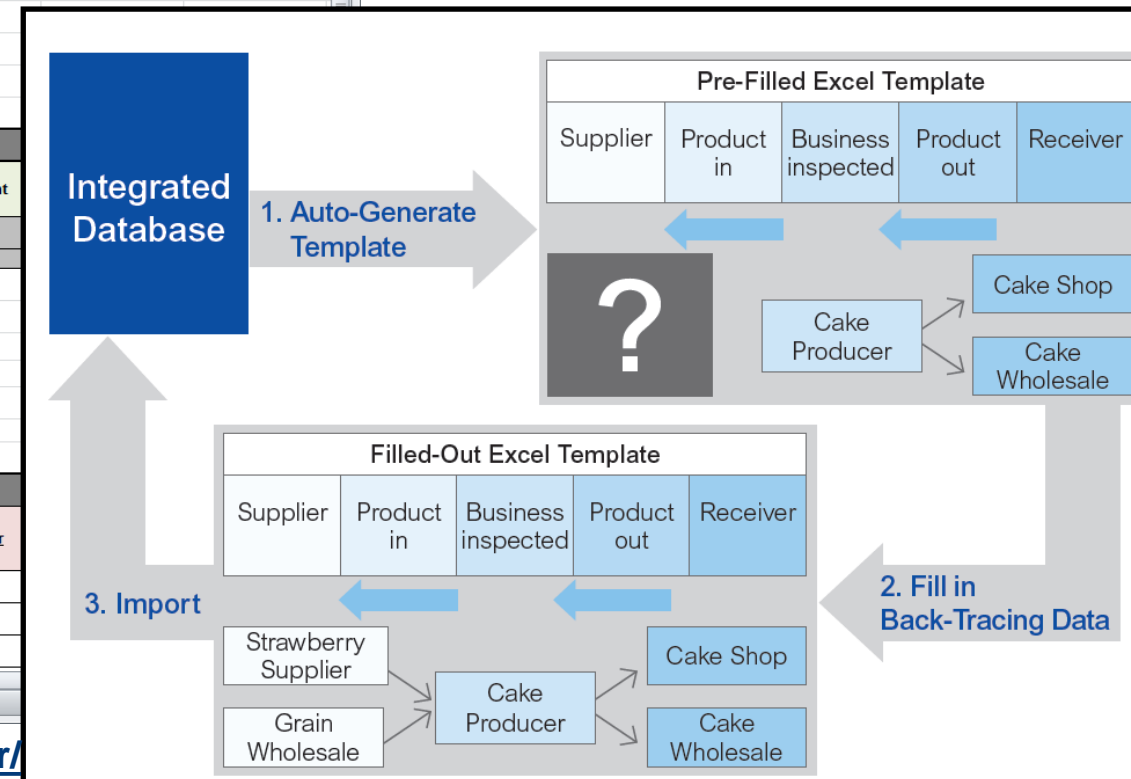
Integrated Database

1. Automatic Template

3. Import

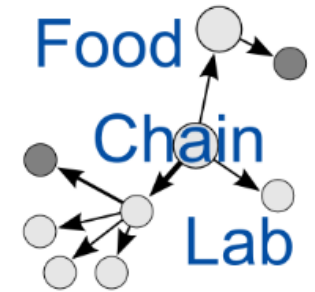
Supplier

Strawberry Supplier



Online Validation: <https://foodrisklabs.bfr.bund.de/templatevalidator/>

What is FoodChain-Lab?



- Open source software
<http://foodrisklabs.bfr.bund.de>
- Database for managing food tracing data
- Tool for data cleaning, enrichment & processing
 - Validation (also online: <https://foodrisklabs.bfr.bund.de/templatevalidator/>)
 - Cleaning (e.g. Duplicate Detection)
 - Enrichment (e.g. Geocoding)
 - Analysis (Clustering, Tracing, Scoring, etc.)
- Tool for visualization and interactive reasoning

Data Cleaning – Duplicate Detection

Company	Street	House Number
Bäcker Maier	Hauptstr.	1
Bäcker Meier	Hauptstraße	1

Levenshtein distance

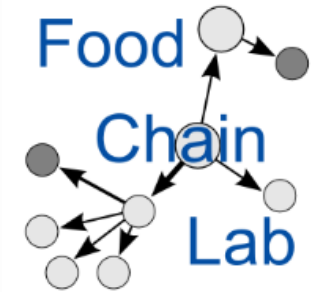
Works well for finding typos

B	I	O	M	R	A	K	T
=	=	=	=	-	-	=	=
B	I	O	M	A	R	K	T

E	L	E	P	H	A	N	T
=	=	=	o	-	=	=	=
E	L	E	F		A	N	T

FoodChain-Lab

Data Enrichment – Geocoding



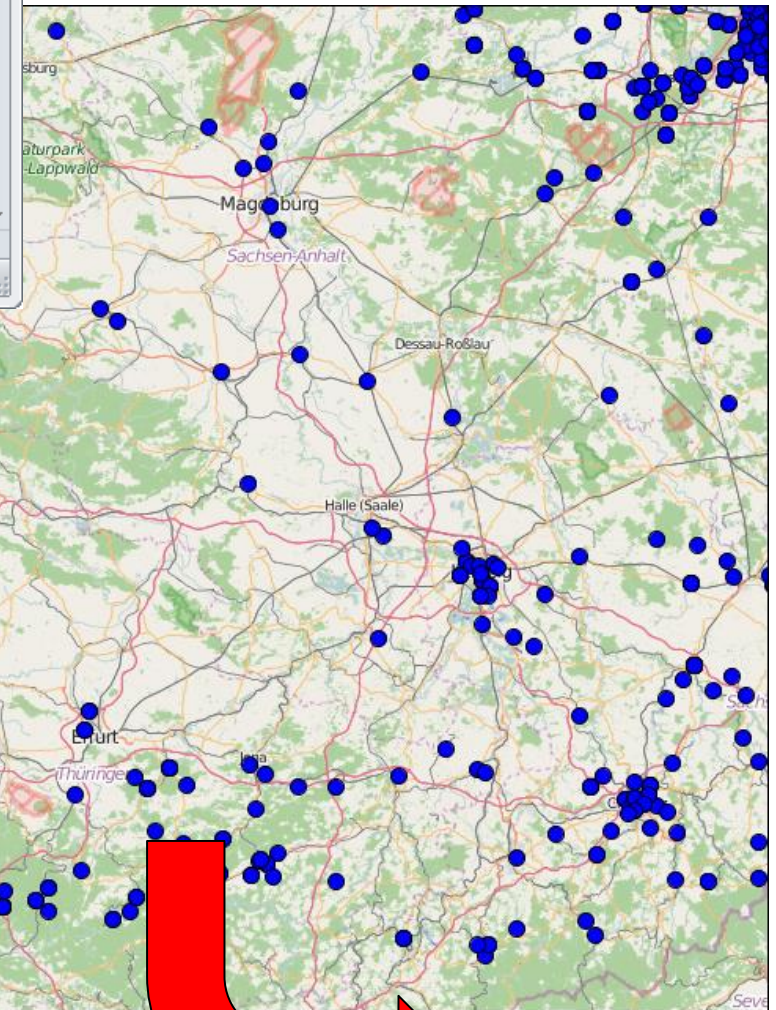
Start_Tracing_Caterers.xlsx - Microsoft Excel

B20 fx Caterer 2

	C	D	E	F	G	H	I
	Street	Street Number	Postal	City	District	State	Country
1							
2	Kantstraße	1	72393	Burladingen			DE
3	Heuweg	1	72417	Jungingen			DE
4	Lichtensteinweg	1	72393	Burladingen			DE
5	Stillfriedstraße	1	72379	Hechingen			DE
6	Steinbeisstraße	1	72501	Gammertingen			DE
7	Gammertinger Straße	1	72379	Hechingen			DE
8	Hechinger Straße	1	72501	Gammertingen			DE
9	Schillerstraße	1	72818	Trochtelfingen			DE
10	Brunnenstraße	1	72417	Jungingen			DE

Stations Deliveries LookUp Help

Bereit



Available Providers:

- (Google)
 - Web service
- MapQuest
 - Web service with open data
- Bundesamt für Kartografie und Geodäsie
 - Germany only
- Gisgraphy
 - Locally installable
 - Data stays confidential
 - Unlimited requests

Tracing Features

Trace: path, a contamination can take via the food chain network

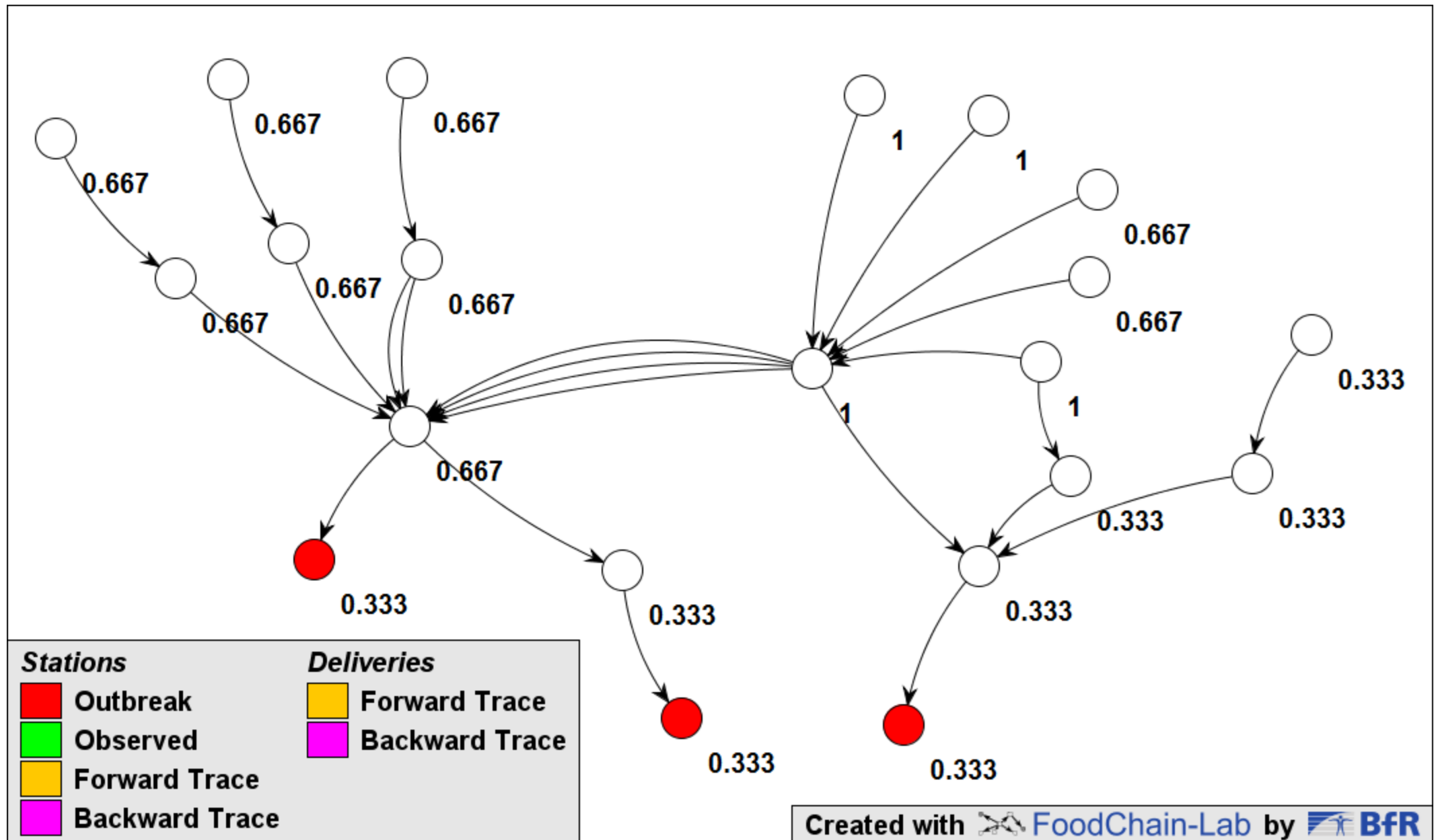
Score: ~ likelihood a station is involved in the outbreak

$$\text{Score}(s_i) = \frac{\sum_{j=1}^n w_j t_{ij}}{\sum_{j=1}^n w_j}$$

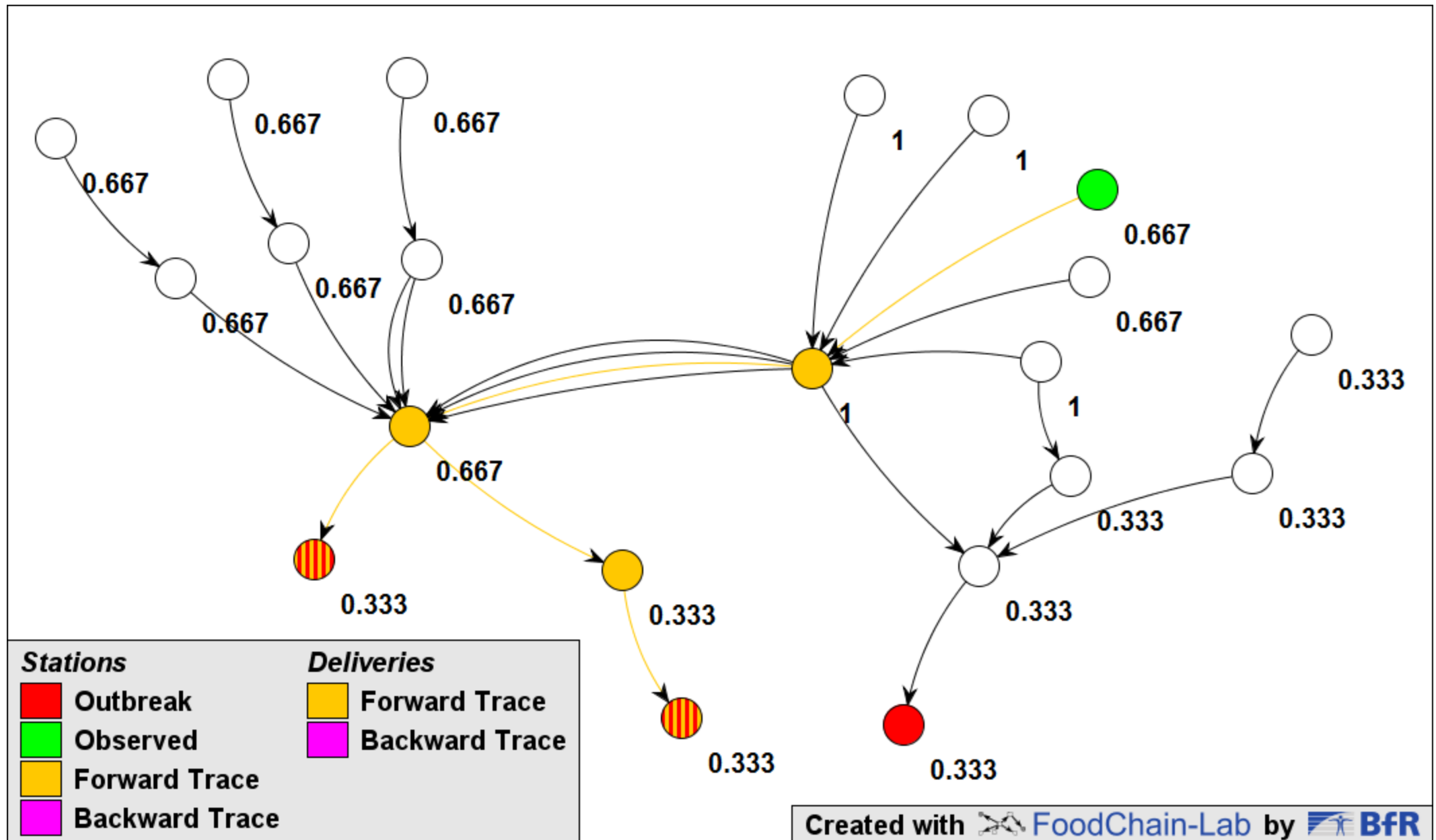
s_i :	Station i
w_j :	Weight of station j
t_{ij} :	1 if there is trace from station i
to j	0 otherwise
n :	Number of stations

- Backward / forward “trace” can be visualized
- User can define:
 - Cross Contamination
 - Regional Effects (e.g. environmental contamination)
 - Weights for Outbreak Stations

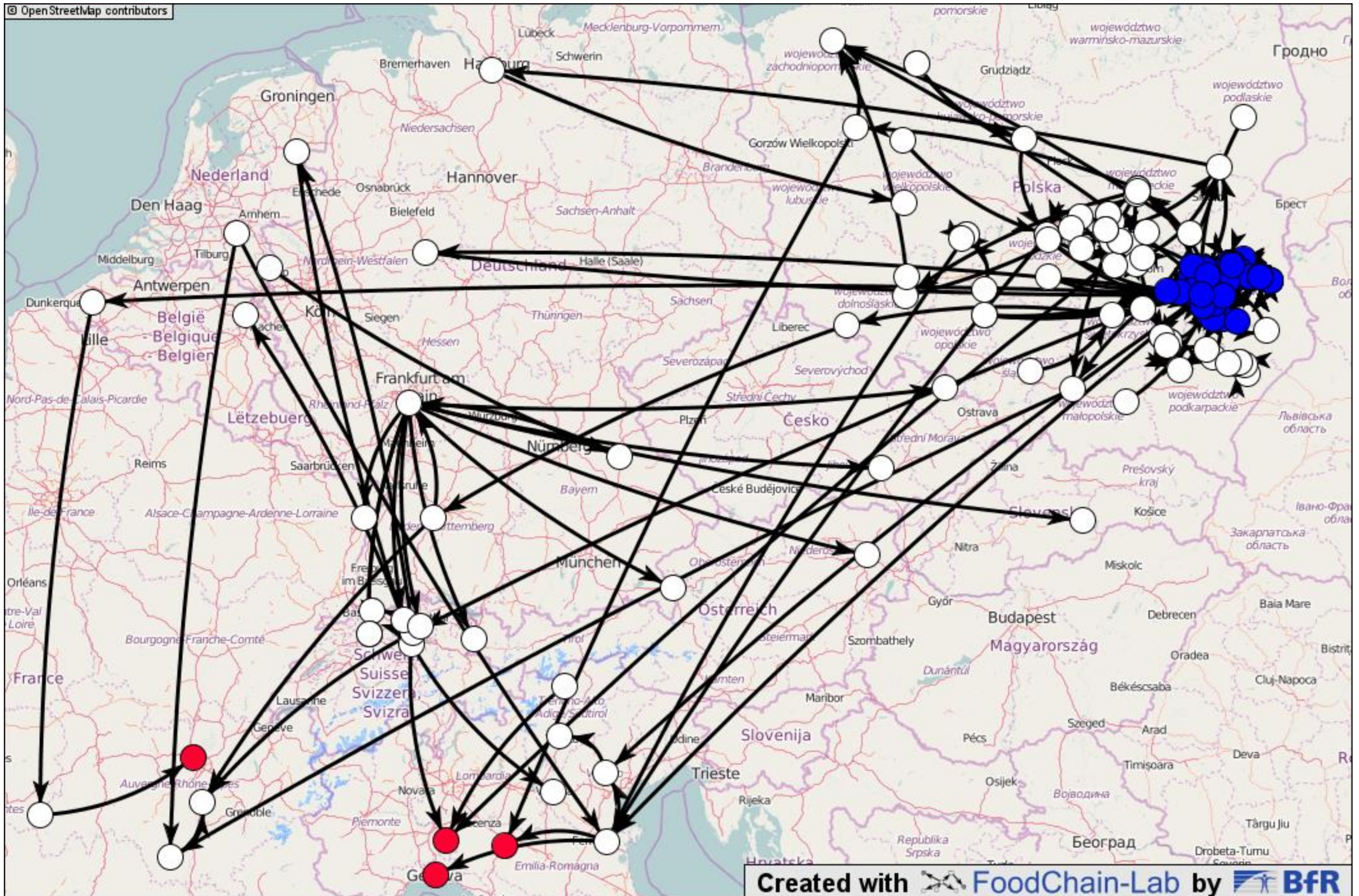
Interactive Visualization - Scores



Interactive Visualization – Forward / Backward Trace

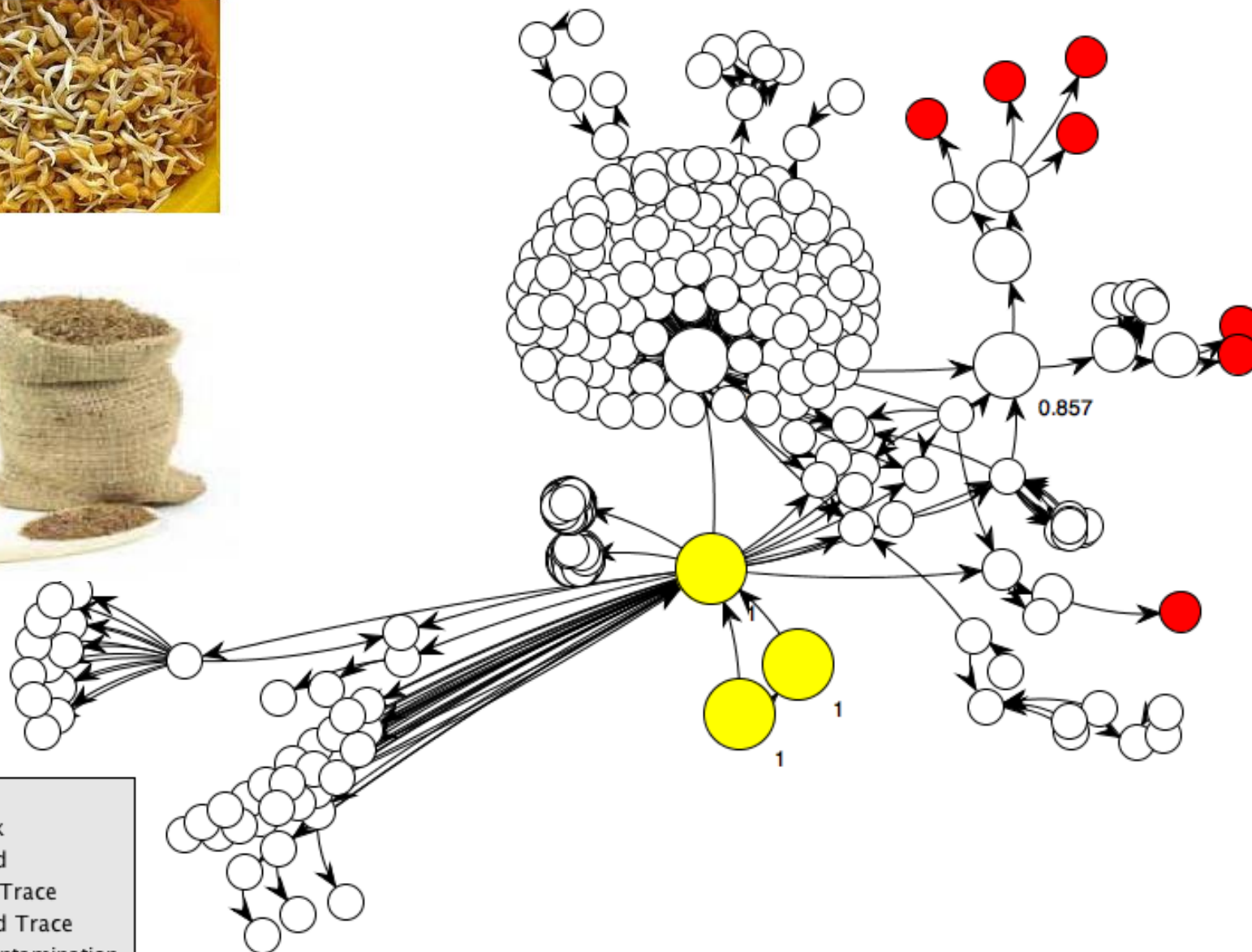


Interactive Visualization - Geographical Clusters



Real world application

EHEC 2011



- Stations**
- Red circle: Outbreak
 - Green circle: Observed
 - Yellow circle: Forward Trace
 - Pink circle: Backward Trace
 - Black circle: Cross Contamination
 - White circle: Common Link

Created with FoodChain-Lab by BfR

Other cases:

DE:
Norovirus 2012



EU:
HAV 2013/14


UK:
EHEC 2016

Benefits of using FoodChain-Lab



- All steps integrated in one modular framework
 - Data Management
 - Data Cleaning
 - Data Analysis
- Helps during Outbreak Investigation
 - Assists in Brainstorming / Prioritizing
 - Identifies missing data
 - Tests hypotheses and generates new ones

FoodRiskLabs



[FoodChain-Lab](#)
[Predictive Microbial Modeling Lab \(PMM-Lab\)](#)
[FoodProcess-Lab](#)
[Open Food Safety Model Repository](#)
[Events](#)
[Contact](#)
[Disclaimer](#)

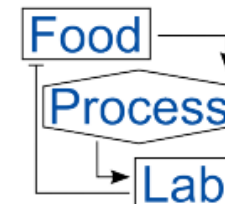
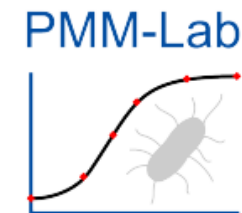
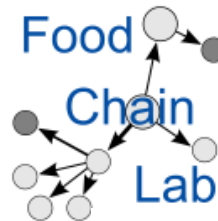
FoodRisk-Labs



FoodRisk-Labs is a portal

to the following tools

developed by the Federal Institute for Risk Assessment (BfR):



open
FSMR



Thank you for your attention

Armin Weiser

<http://foodrisklabs.bfr.bund.de>

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