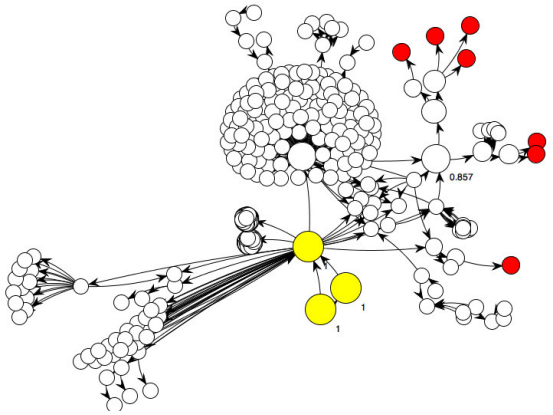
GERMAN FEDERAL INSTITUTE FOR RISK ASSESSMENT

FoodChain-Lab Web: An integrative software to visualise and analyse complex global food supply chain networks during foodborne incidents

Marion Gottschald, Alexander Falenski, Marco Rügen, Birgit Lewicki, Isaak Gerber, Jakub Fusiak, Dominic Tölle, Annemarie Käsbohrer, Armin Weiser



FCL was supported by EFSA-BfR Framework Partnership Agreements (FPA) GP/EFSA/AMU/2016/01 and GP/EFSA/AMU/2020/02, and received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830 (OH EJP COHESIVE).

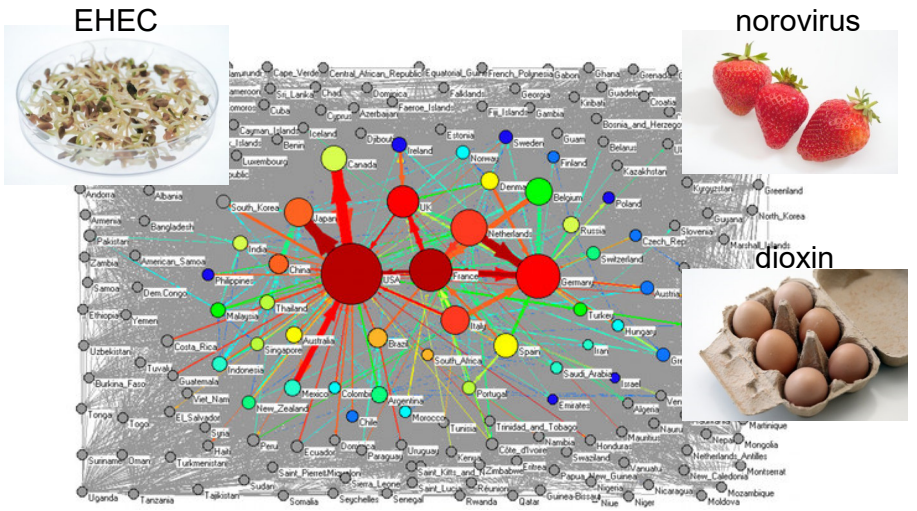
Why do we need FoodChain-Lab?

Globalised food and feed trade:

- Long and complex supply chains
- Huge amounts of data

Challenges:

- Fast spread of contaminations
- Facilitates food fraud
- Increased complexity of risk assessment



Ercsey-Ravasz M et al. (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

Importance of powerful integrative software tools

Traceability/Tracing

What is tracing? (Regulation (EC) No. 178/2002, Art. 18)

1) … **at all stages of production, processing and distribution**…

2) **Food and feed business operators** shall be able to **identify any food company from** whom they have been **supplied** …

3) …**to** which their products have been **delivered**.

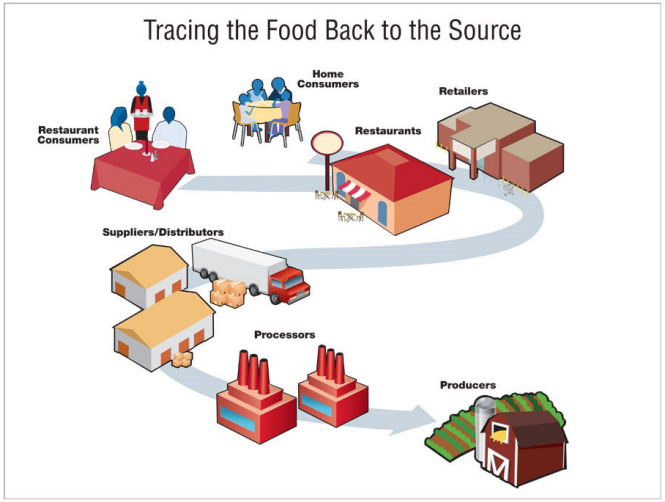
Purpose of tracing

- identify source of contamination + distribution of contaminated food

  warning of consumers
  remove contaminated food from market

- compare distribution of cases + contaminated food

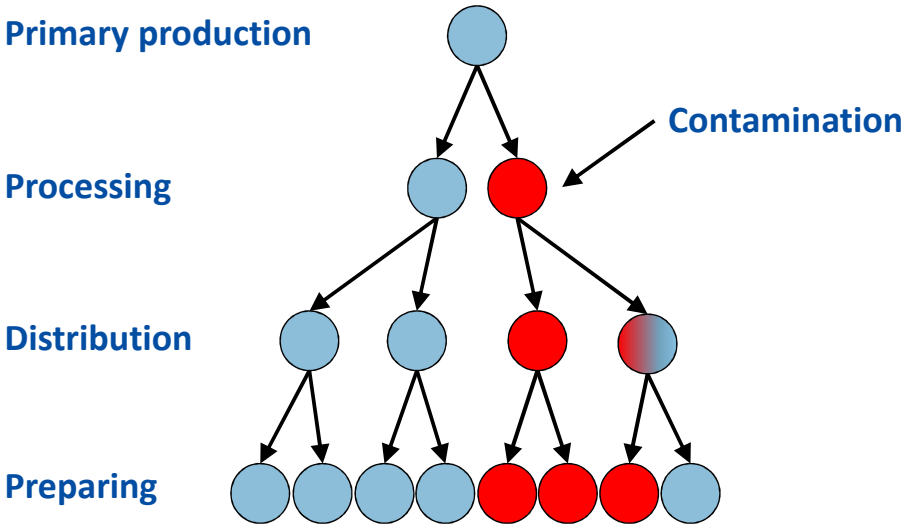
  strengthen epidemiological association



CDC: https://www.cdc.gov/outbreaknet/investigations/figure_traceback.html

Tracing in foodborne crises

Foodborne disease outbreak affecting multiple locations/countries



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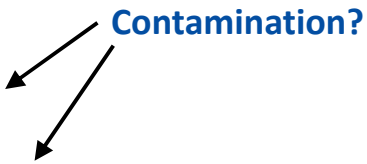

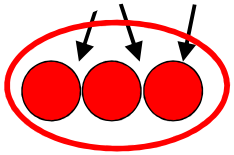

The outbreak investigation teams can only see cases

Tracing in foodborne crises

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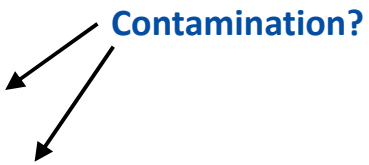

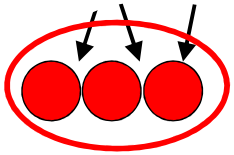

The outbreak investigation teams can only see cases

Tracing

Interview: Who ate what, when, where, how much and how?

→ Suspicious product?

Tracing in foodborne crises

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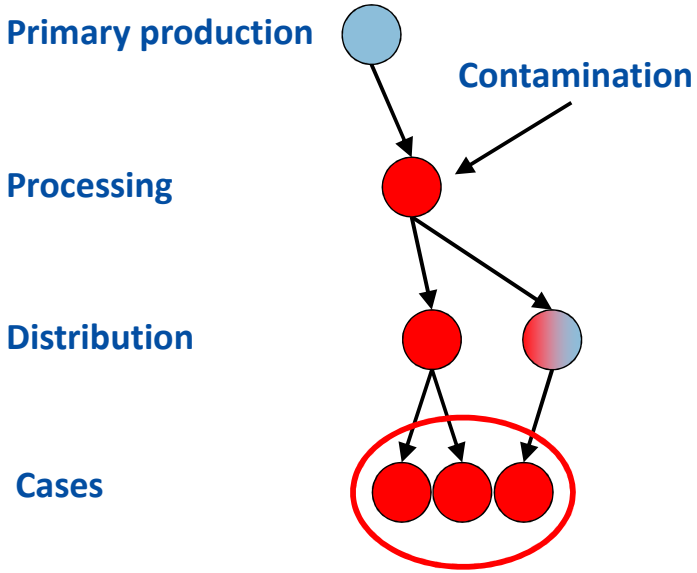
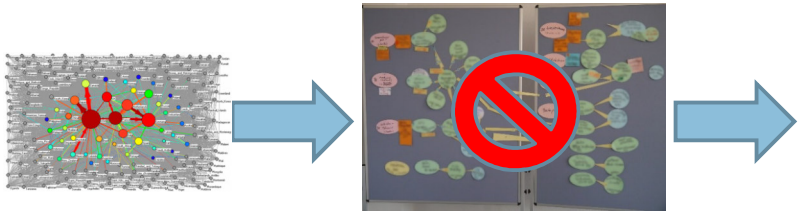


Backtracing

- Step-by-step upstream the supply chain (REGULATION (EC) No 178/2002)
- Collecting delivery data for suspicious products and their ingredients
- Combine fragmented information
- Origin of contamination?



Food Chain Lab
Powered by BfR

efsa
One HEALTH EJP
COHESIVE

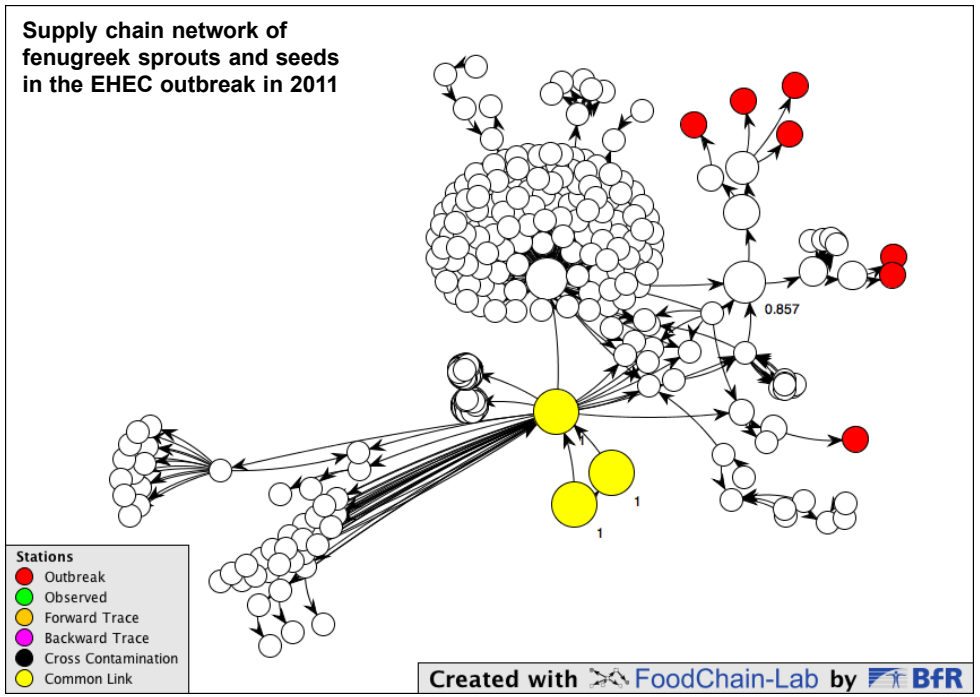
FoodChain-Lab – What is it?

- Free open source software (https://foodrisklabs.bfr.bund.de/foodchain-lab/)
- Tool to trace back and forward suspicious food items along complex supply chains to help solving foodborne crises (outbreaks, chemical contaminations)
- Available as **desktop version** and **web application**

  https://foodrisklabs.bfr.bund.de
  + data collection/ cleaning

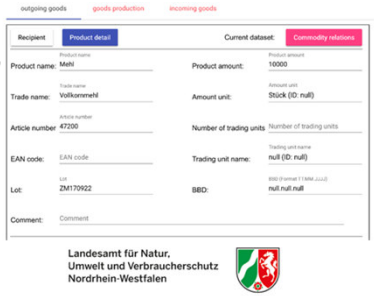
  https://fcl-portal.bfr.berlin
  data collection/cleaning coming soon

- Data collection via Exceltemplates, web-based data collection tool, interface for mass data envisioned
- Automated visualisation of food business operators and deliveries
- Automated analysis of supply chain network to identify potential common source of pathogen/contamination and disease cases
- Interactive analysis, simulation of hypotheses (e.g. cross contamination
- Helps prioritizing next investigation steps



The FoodChain-Lab web application (FCL Web)

North Rhine-Westphalia cooperation
- Tracing data collection tool

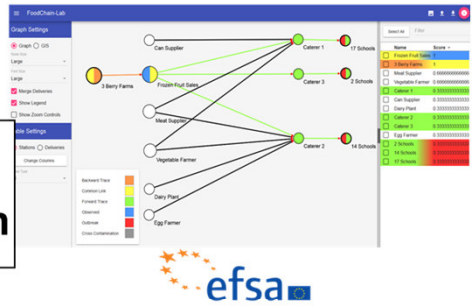


The Tracing (Web-) Portal

https://fcl-portal.bfr.berlin/

Data Collection
RASFF
Local
Bulk

Data Analysis & Visualization

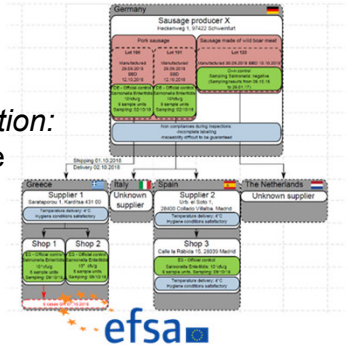


Reporting

Sync with Desktop App

KNIME

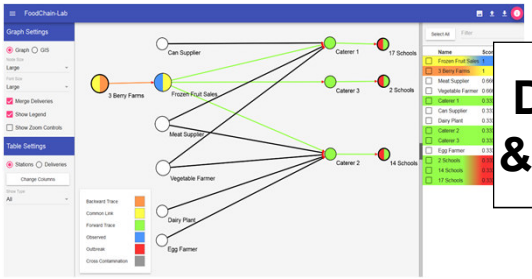
EFSA-BfR cooperation:
- Reporting module



OH EJP NOVA:
- NOVA gravity model and webtool

EFSA-BfR cooperation:
- Tracing web platform including desktop FoodChain-Lab for tracing needs

The FoodChain-Lab web application (FCL Web)



Data Analysis & Visualization

efsa

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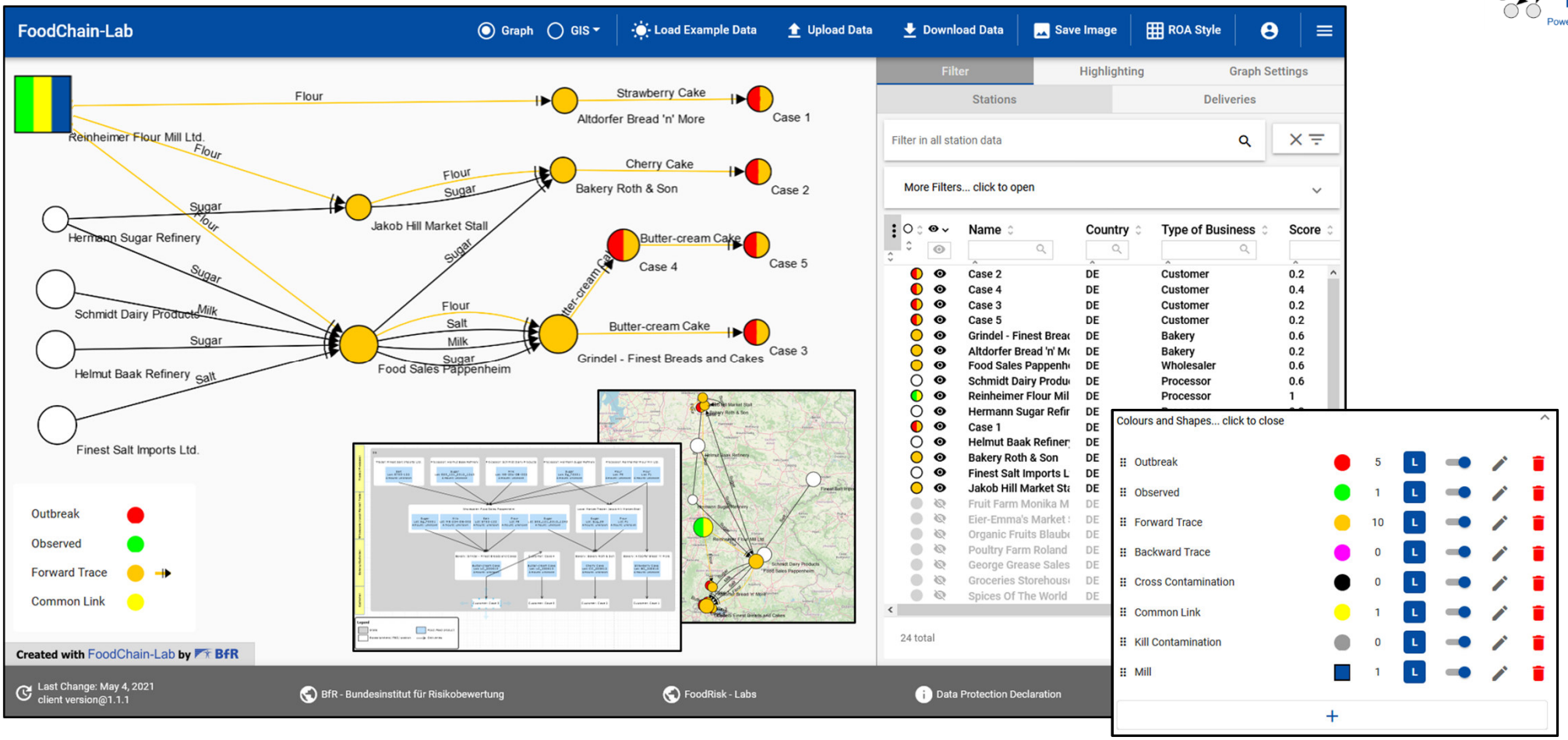
FoodChain-Lab web app:

- browser-based
- easy and intuitive user interface, visualisation and analysis tools
- additional automated layout styles
- JSON-based data exchange with FCL desktop version
- data stay on client side → data security/data protection

→ web app is basis for new data collection,data management and reporting features of FCL

→ future aim: replace desktop app for simple standard analyses

FCL Web – network view, map view, reporting view and data



*FCL Web visualising the supply chain network of a fictitious foodborne disease outbreak in the **network view**, the **map view**, the **reporting view** and in the **data table**.*

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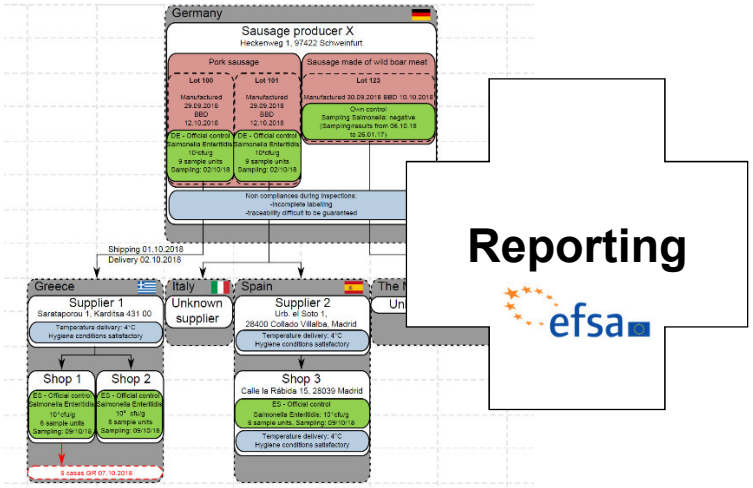
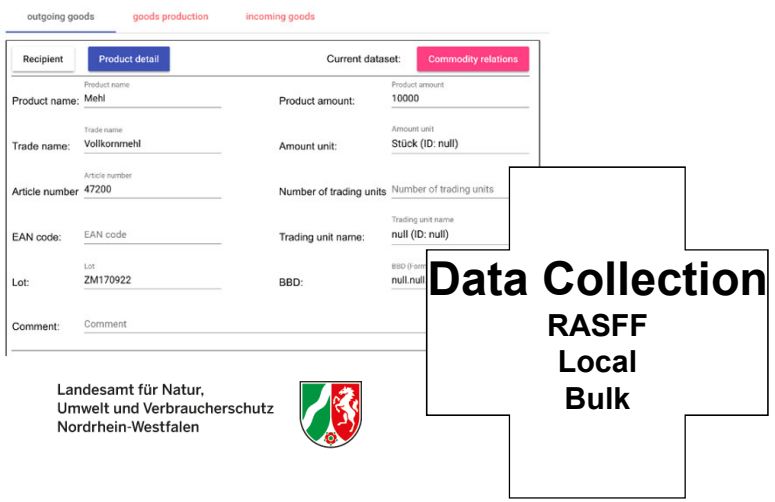


Visualisation for Rapid Outbreak Assessments and other (national) reports:

- in one click from network to reporting view
- structured, harmonised figures
- fully editable
- save and continue later
- export in PDF

The FoodChain-Lab web application (FCL Web)



Pilot version - Data entry mask (initiative of LANUV NRW in cooperation with BfR, EFSA, BVL):

- browser-based data collection form for local authorities
- guided, structured data assessment
- on-site plausibility checks
- interfaces to registers providing curated master data, to industry databases and to RASFF system planned
- use of catalogs (**exchangeable**)
- developed to allow **multilingual** use

→ will be tested in realistic tracing exercise
→ improvement of data quality and speed of data collection
→ potential German-wide/EU-wide use taken into account during software development

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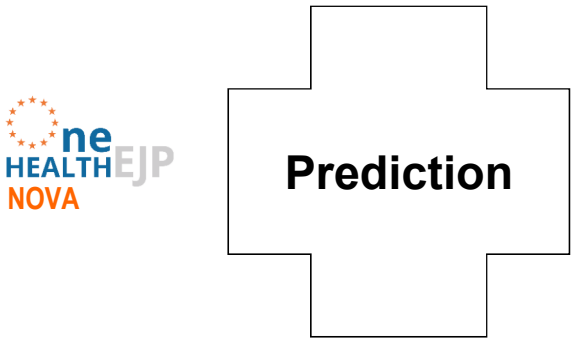

Estimation of probability of food items to be cause of outbreak:

- when you could not identify suspicious food item from epidemiological/microbiological investigation
- data sources: local distribution of disease cases, whole sale data, census data
- webservice (compatible with KNIME; available in FCL Web soon)

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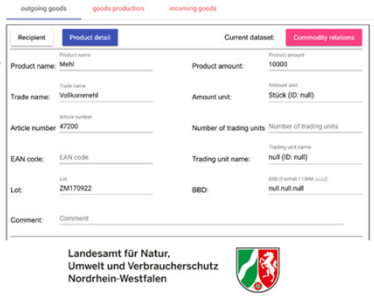

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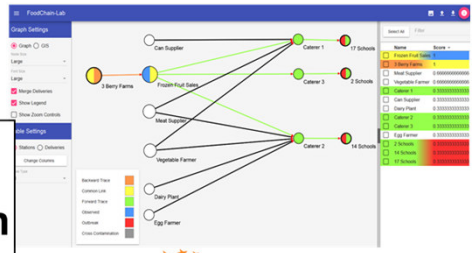
One HEALTH EJP COHESIVE



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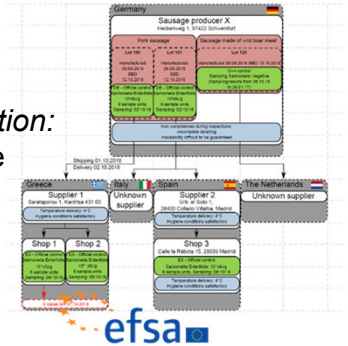

OH EJP NOVA:
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KNIME

COHESIVE:
- Server for platform, restricted user area, legal framework
- Software integration

Live demo FCL Web

- Available at https://fcl-portal.bfr.berlin

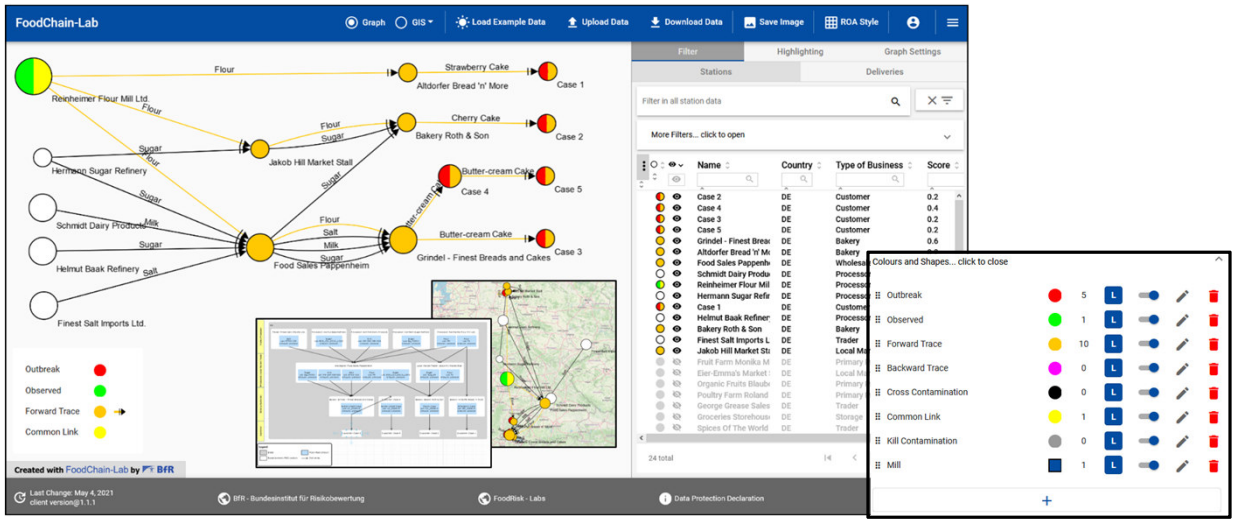
  Everybody can register to get access to FCL Web

- Try out on your own by loading the example data

- Explore functionalities …
  - … in blue menu bar on the top
  - … by right-click on stations/deliveries/empty space

Feedback and feature requests?

Please contact foodrisklabs@bfr.bund.de
Or
create ticket at https://github.com/SiLeBAT/fcl-client



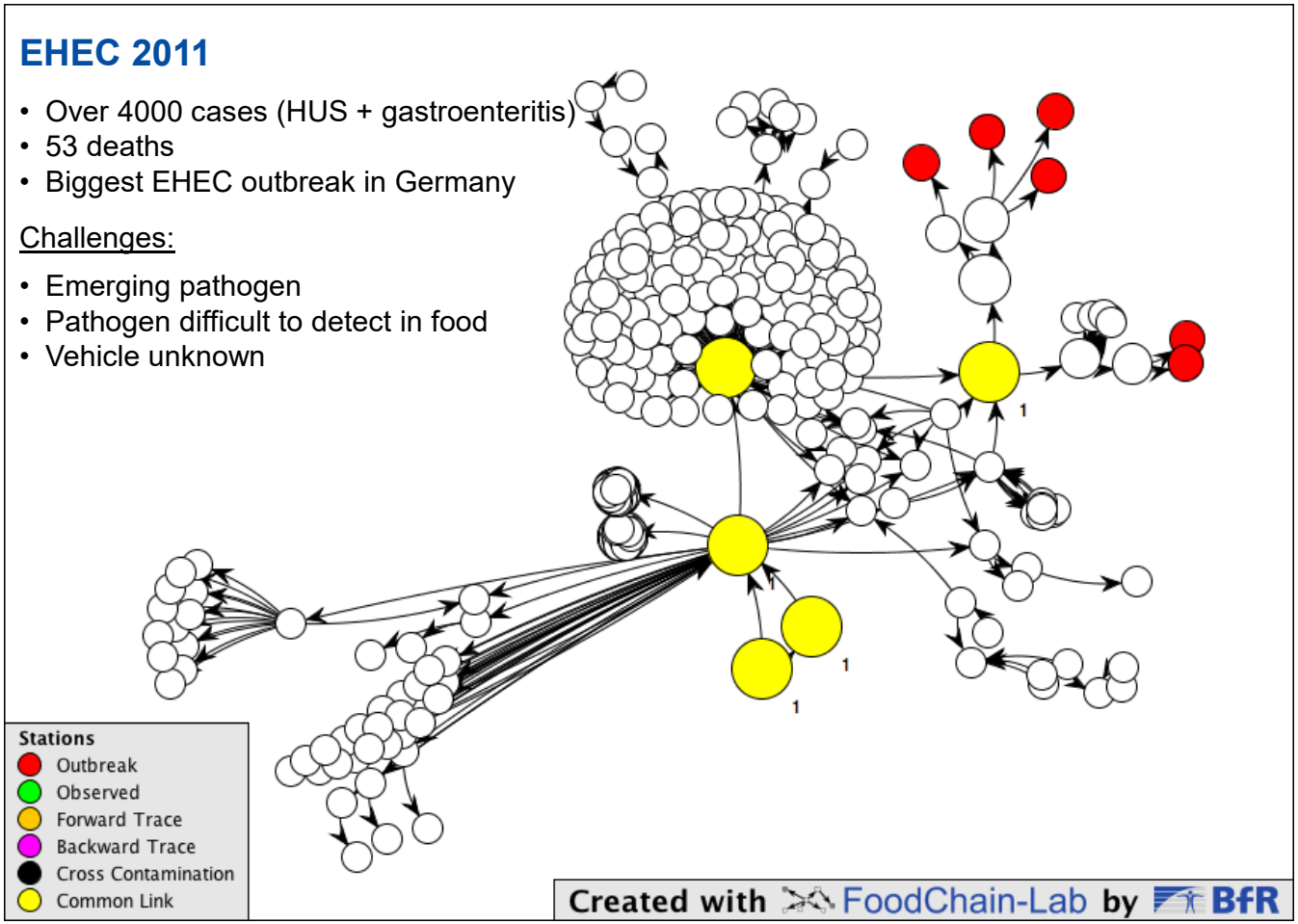
FoodChain-Lab – Successful applications and impact

EHEC 2011

- Over 4000 cases (HUS + gastroenteritis)
- 53 deaths
- Biggest EHEC outbreak in Germany

Challenges:

- Emerging pathogen
- Pathogen difficult to detect in food
- Vehicle unknown



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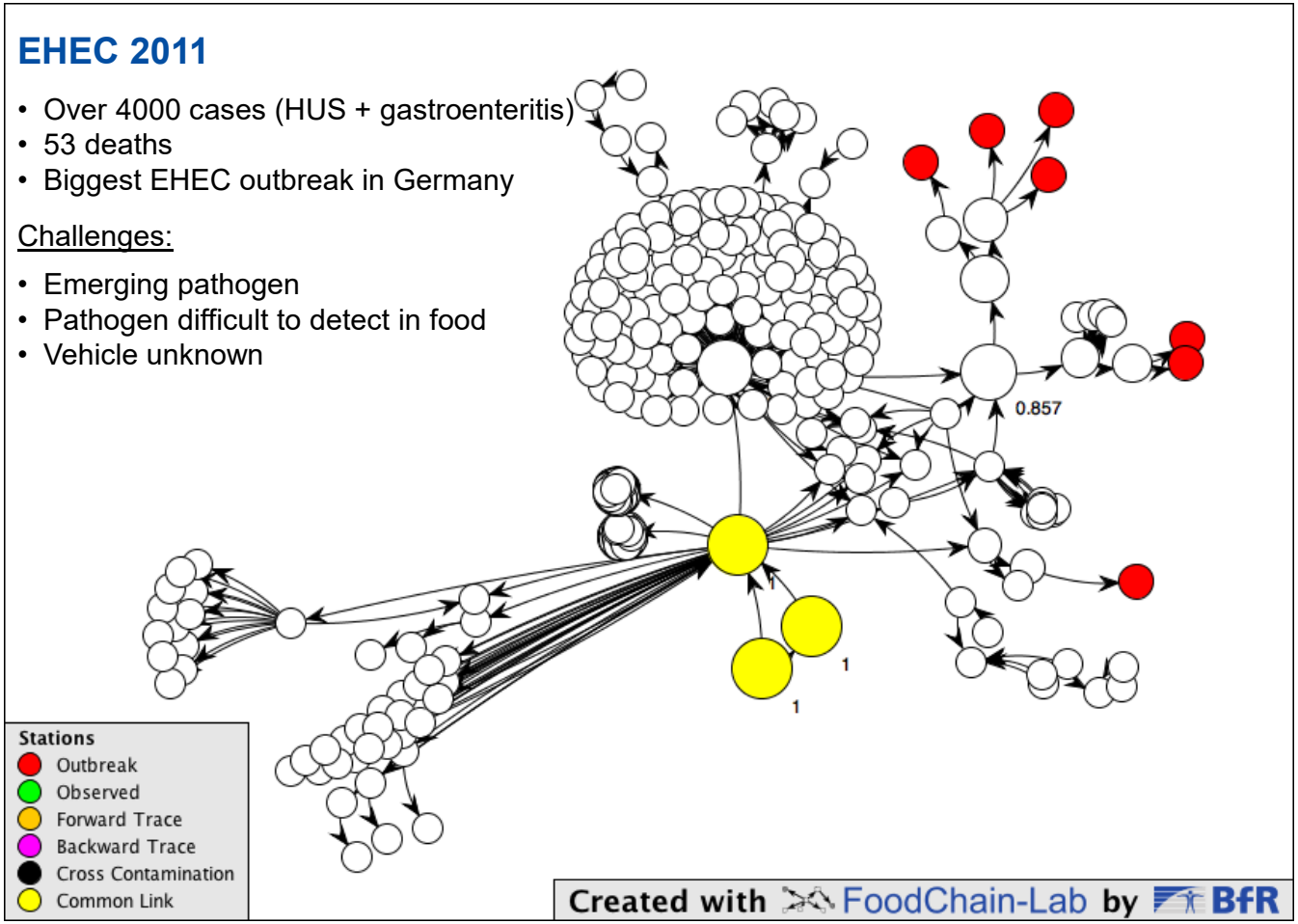

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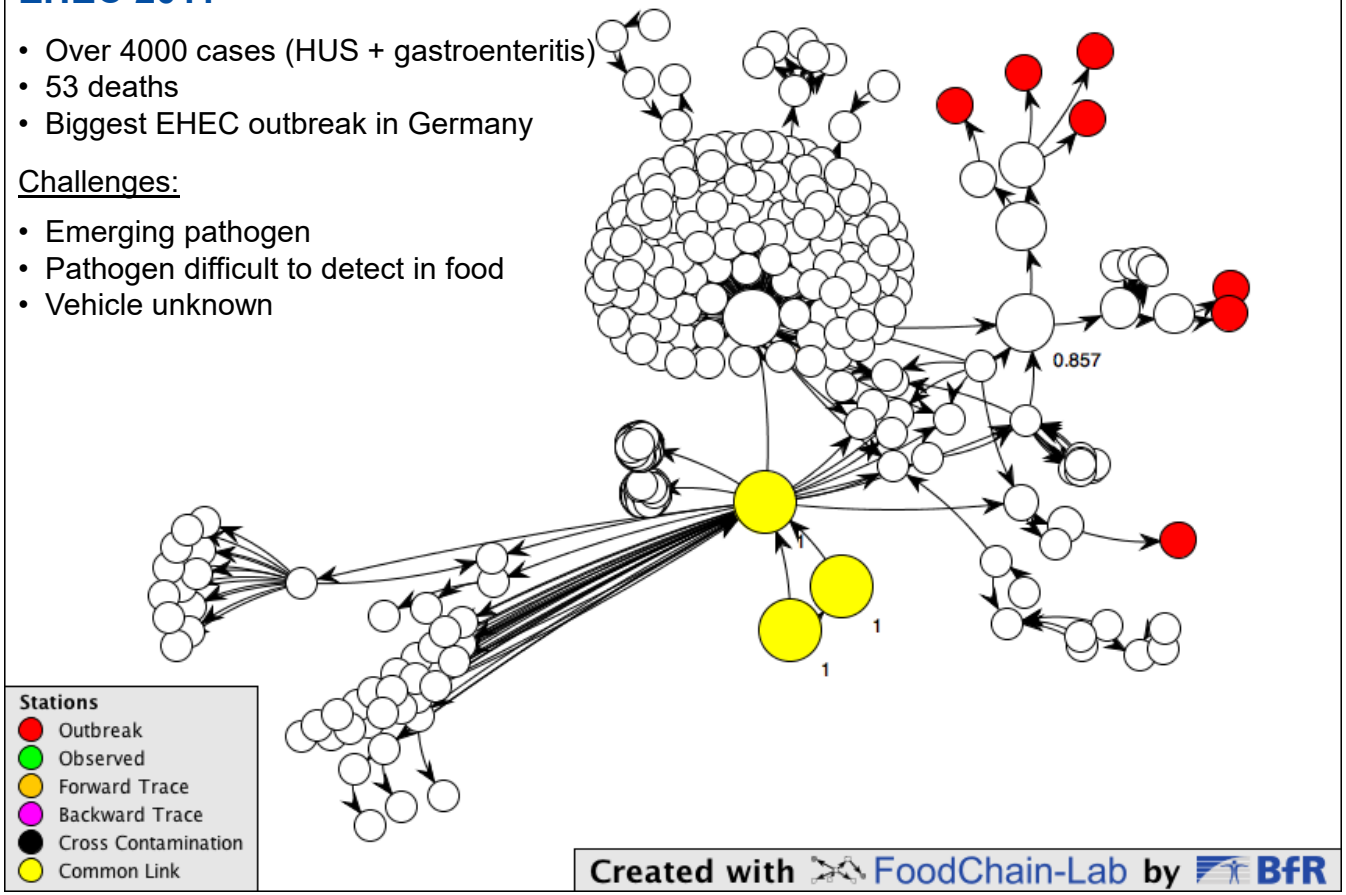

Other applications:

DE:
Norovirus 2012, Salm M. 2015,
EHEC 2017, Fipronil 2017

EU:
HAV 2013/14, C. Bot. 2017 (Plötze),
Salm 2017 (Sesam)

Autonomous applications:
UK, AT, ES, HU, PL

Free support by FCL team efsa

Interested?
Please contact foodrisklabs@bfr.bund.de

Impact:

FAO/WHO/OIE: FCL part of Tripartite Tool Box (SISOT)

U.S. FDA implemented FCL and FCL Web in data analysis workflow

FoodChain-Lab – Free user trainings within EFSA-BfR-FPA

11 FCL trainings and EFSA crisis exercises

- one or more experts from 23 MS and from EFSA, ECDC, DG-SANTE and EC attended
- all in all >300 participants

Free user trainings efsa

Interested?

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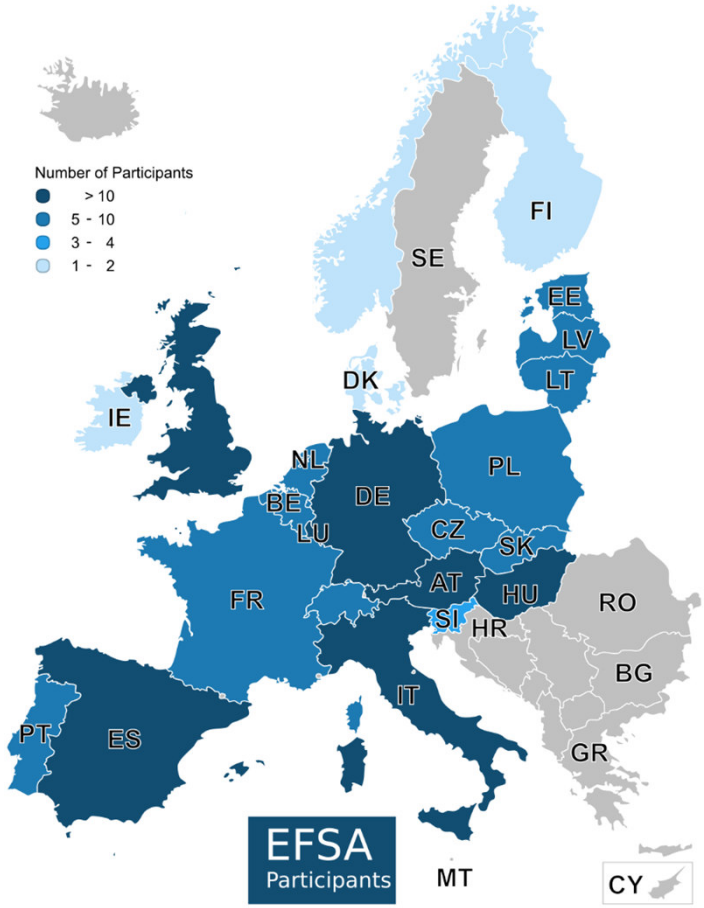
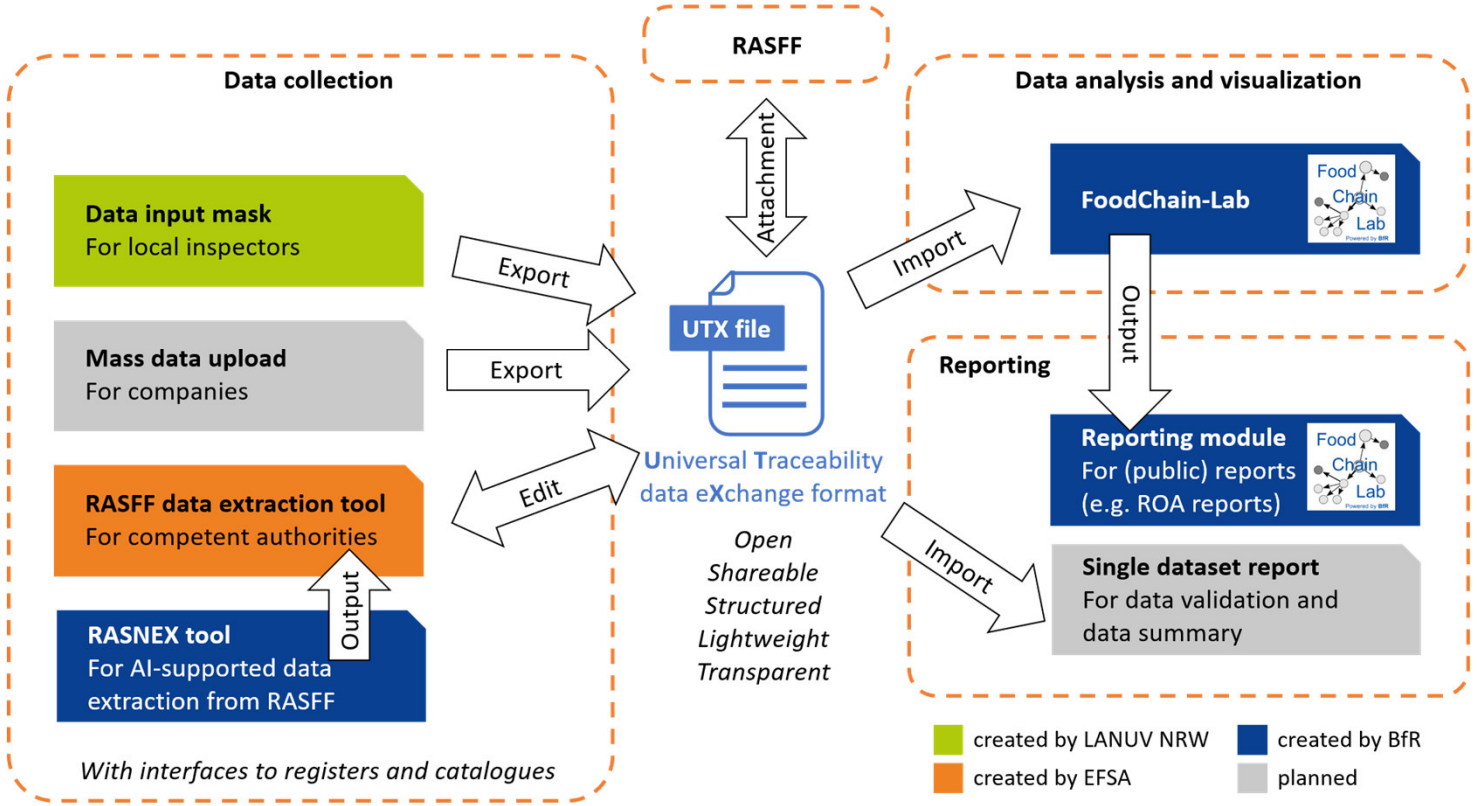


Number of FCL workshop participants per country (2015-2021). *The overview includes mainly workshops conducted in the framework of the EFSA-BfR FPA but also some conducted in other contexts. Increasing colour intensity indicates increasing number of participants.*

FCL Web – Where does the road take us?

EFSA-BfR cooperation on multiactor tracing software workflow + universal traceability data exchange format

Tracing software ecosystem for Europe



Benefits:

Facilitate data exchange

Avoid double work

Easy visualisation + analysis

Your tool?
Feedback on UTX?

Please contact
foodrisklabs@bfr.bund.de

Universal Traceability data exchange format (UTX)

Universal Traceability
data eXchange format

Open
Shareable
Structured
Lightweight
Transparent

Harmonisation of data models is key for interoperability → UTX standard

Structured:
- Core information (investigation, product, station, activities) is interoperable (standardised part of UTX)
- additional unstructured part → offers flexibility to include data which are characteristic for specific tools

Open + Shareable:
- All tools respecting the UTX standard can be used
- Can be uploaded to RASFF system

Transparent:
- Information source is noted

Lightweight:
- JSON or XML file

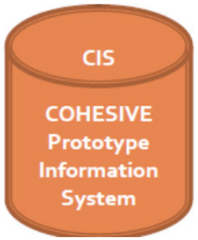
Benefits of using FoodChain-Lab for MS/EU authorities

- Free and open-source software
- Unifies stepwise tracing information in visualization
- All steps integrated in one modular framework
  - *Data Management, Data Cleaning, Data Analysis (automated, calculation of scores)*
- Helps during Outbreak Investigation
  - *Identify potential common source of contamination by tracing back and forward suspicious food items*
  - *Assists in brainstorming → test hypotheses and generate new ones*
  - *Helps prioritizing next steps*
  - *Identifies missing data*
- Free support and free trainings in FCL
- Harmonisation with/integration of other tools and initiatives

→ Fast and reliable investigation of foodborne incidents

The OHEJP COHESIVE software suite

OH EJP COHESIVE developed a **suite of integrative IT tools and data formats** that are quickly available, usable and helpful in surveillance, outbreak situations and for risk assessments - **for MS and EU-level authorities**.



CIS Demo: https://cohesive.izs.it/
CIS Wiki: https://cohesive.izs.it/wiki/user/

https://fcl-portal.bfr.berlin

http://shiny.bfr.bund.de/apps/shiny-rrisk

GERMAN FEDERAL INSTITUTE FOR RISK ASSESSMENT

Bundesinstitut für Risikobewertung

Thank you for your attention

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(Extended) FoodChain-Lab Team

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