

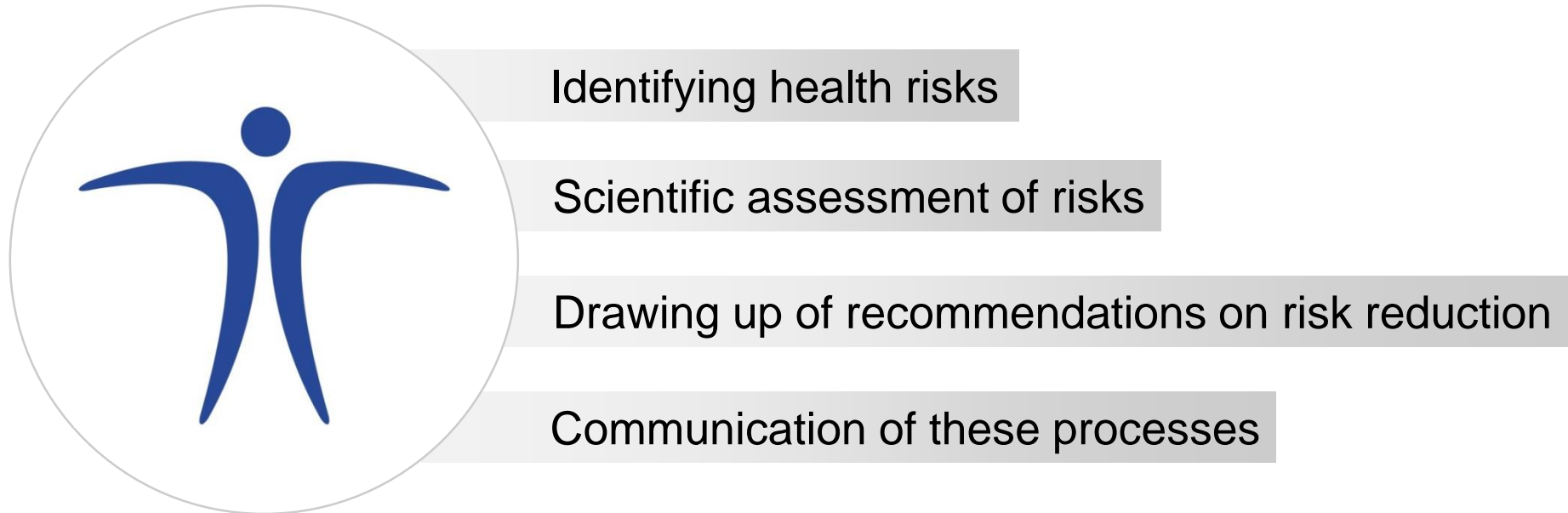
Enabling Efficient Food Safety Knowledge Exchange with FSK-Lab

**Matthias Filter -
on behalf of the FoodRisk-Lab team in unit 41**

Federal Institute for Risk Assessment (BfR), Germany

Federal Institute for Risk Assessment

Overall **goal**: Strengthening of consumer health protection



Work fields



Risk Communication



Product Safety



© Fotolia

Food Safety

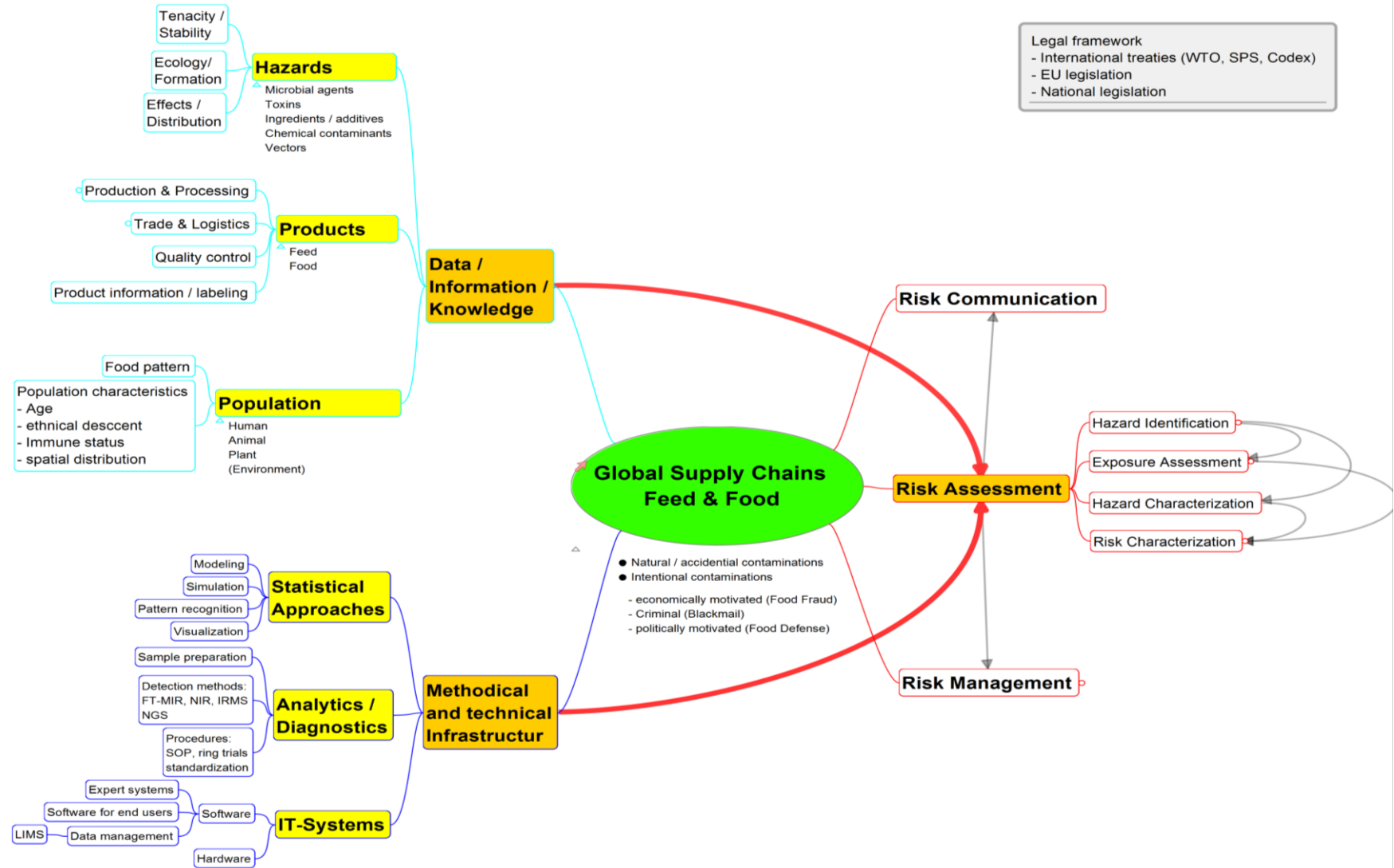


Chemical Safety



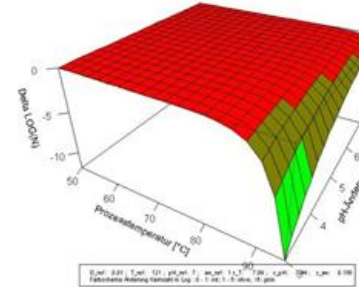
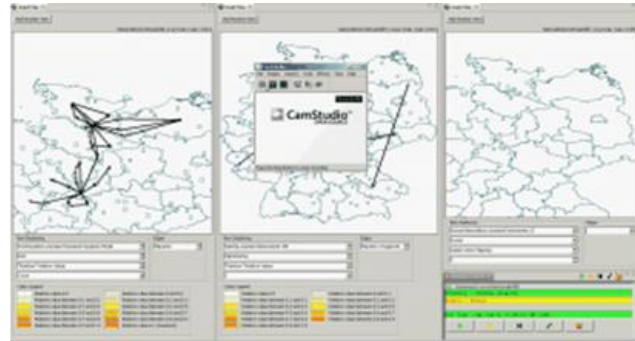
© Julia Pöpke

Risk Assessment = Knowledge Integration

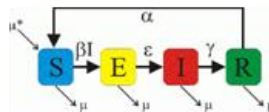


Implications

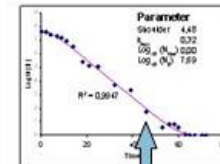
Risk assessors need to use “models”



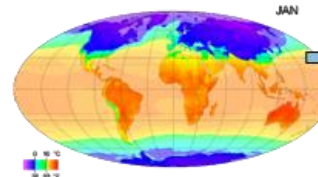
animal disease
models



food processing and distribution



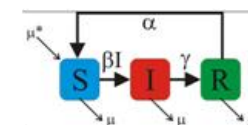
Environmental factors



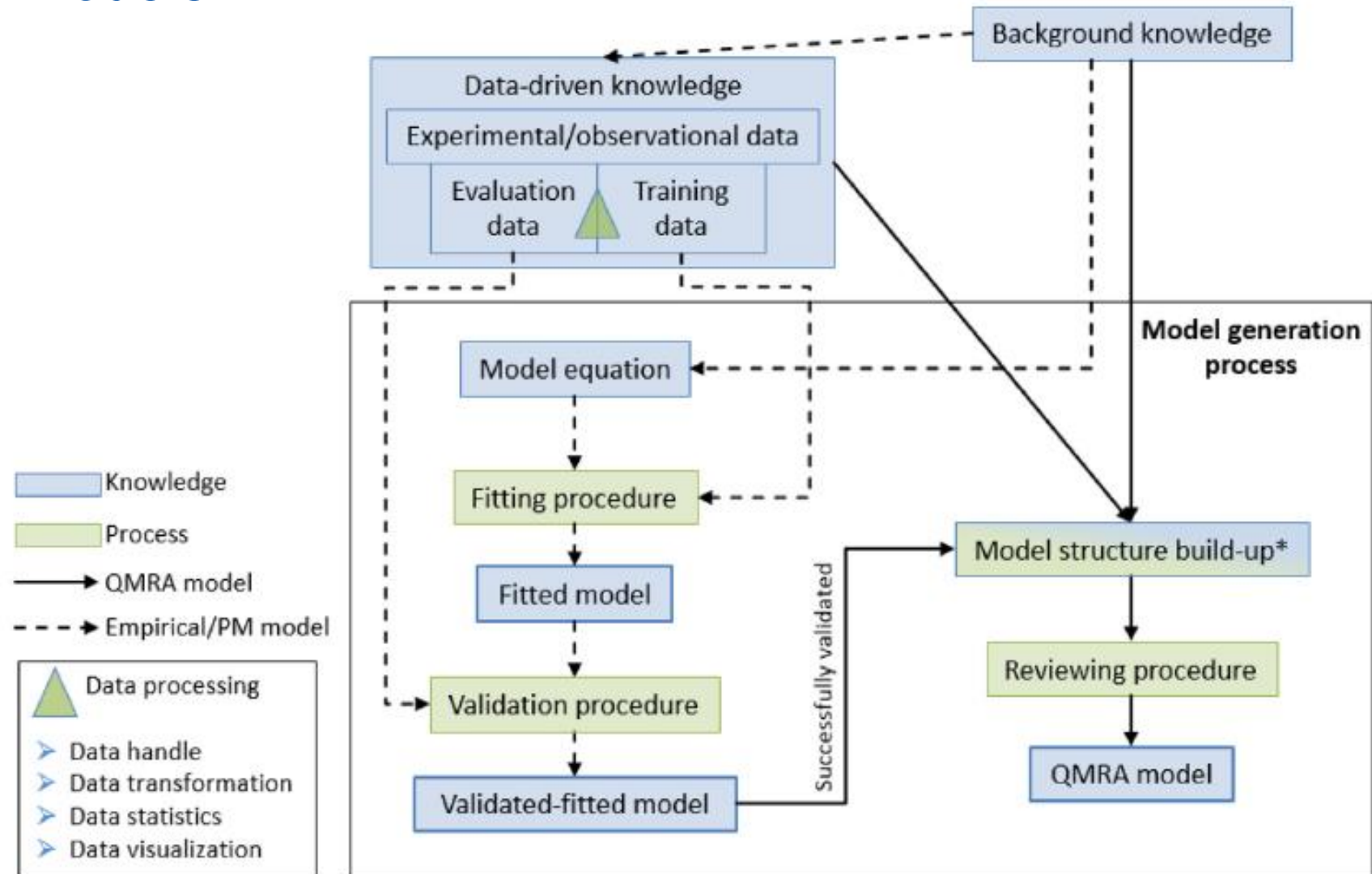
Processing parameters



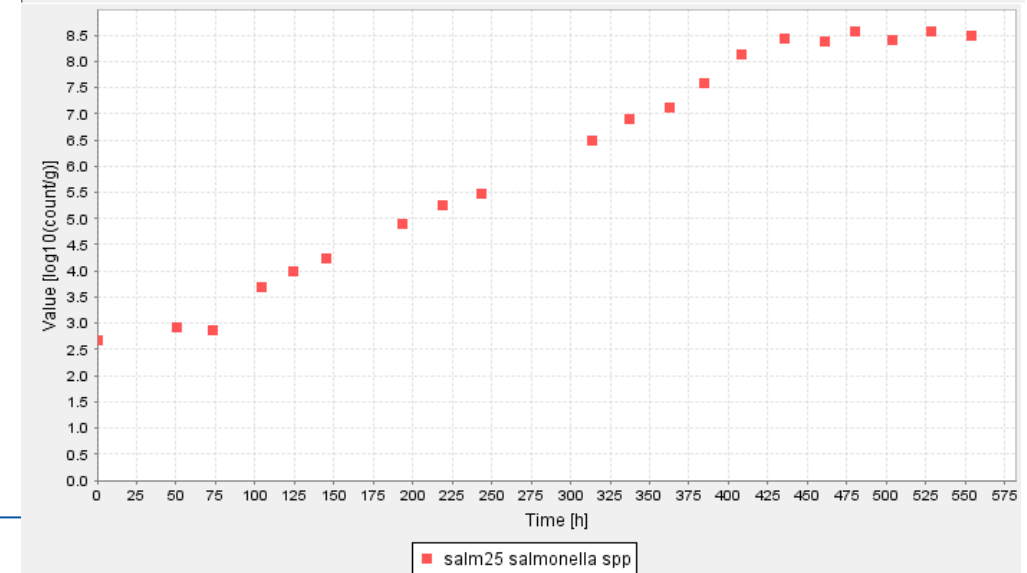
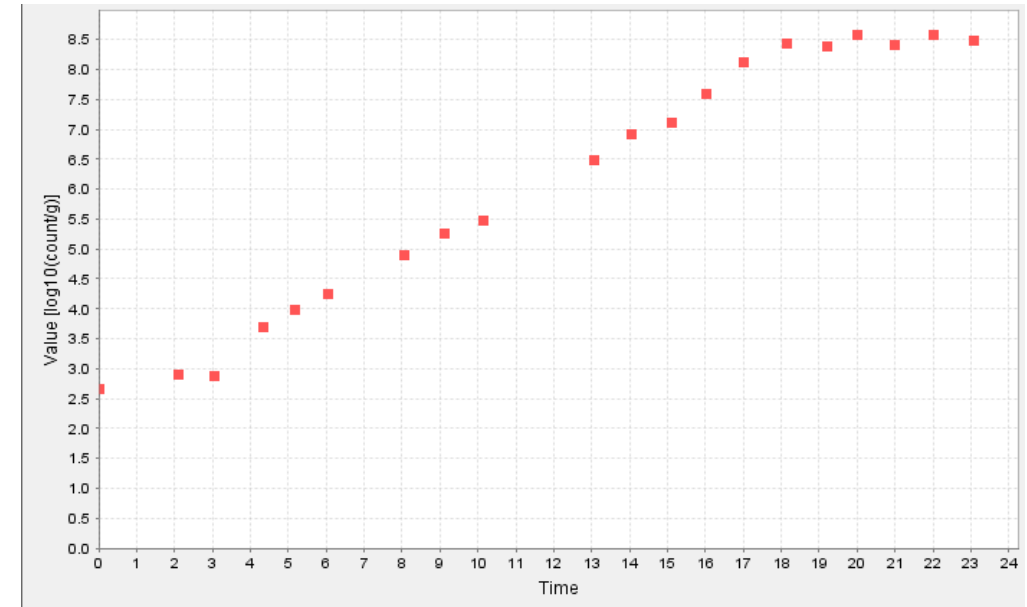
human disease
models



Food Safety Models

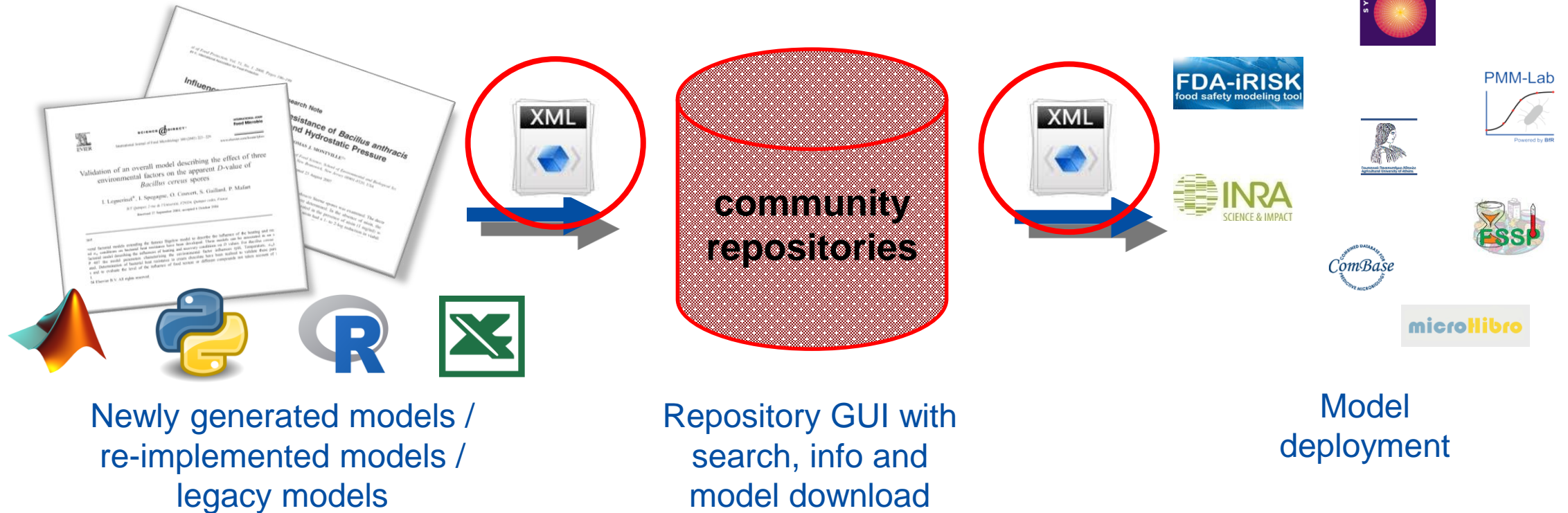


Specific Challenges for Risk Assessment Models

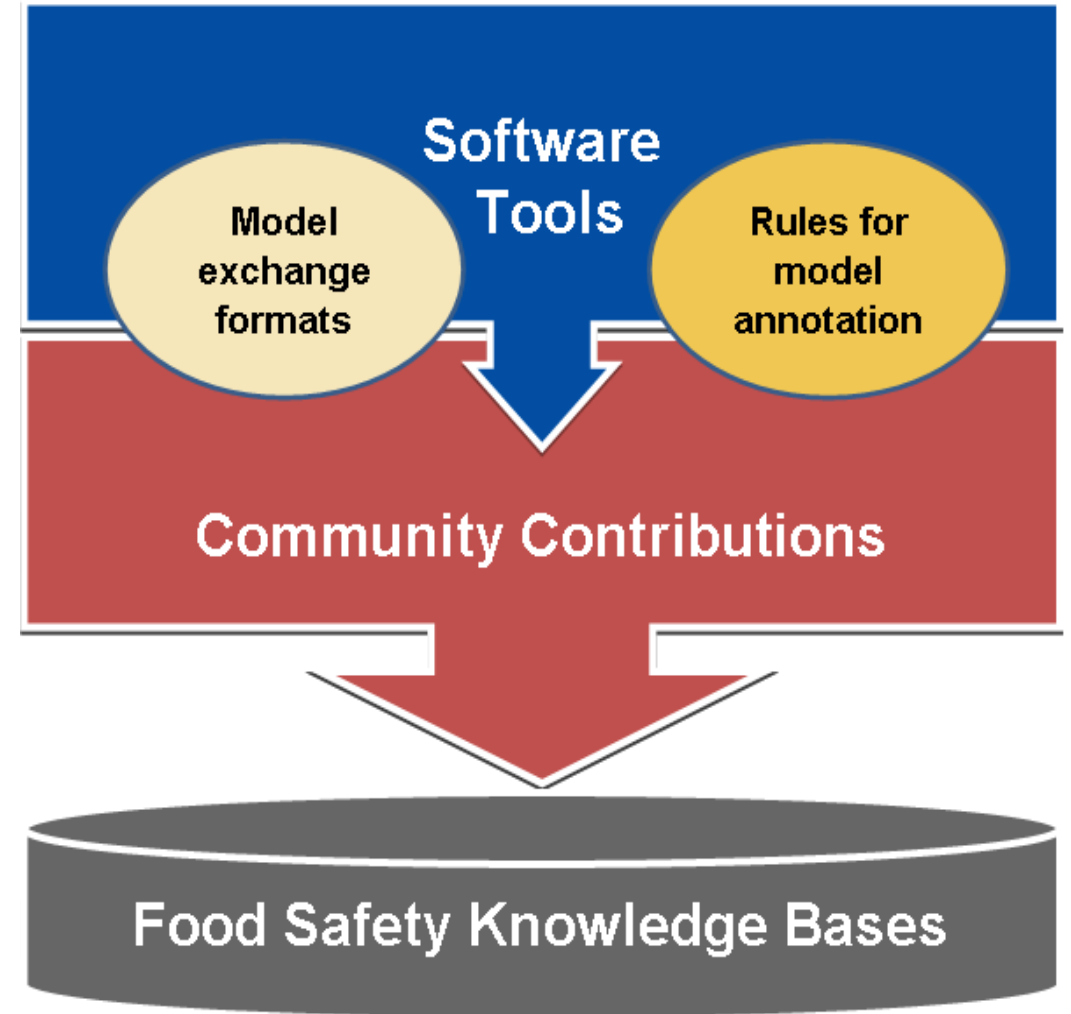


Vision

Community-driven, curated repositories for food safety models / model modules



Long Term Strategy



<http://www.researchgate.net/publication/273791203> A strategy to establish Food Safety Model Repositories

FSK-ML – a community standard for knowledge exchange

Food Safety Knowledge Markup Language (FSK-ML)

Software Developer Guide

Version 2.0 (under review)

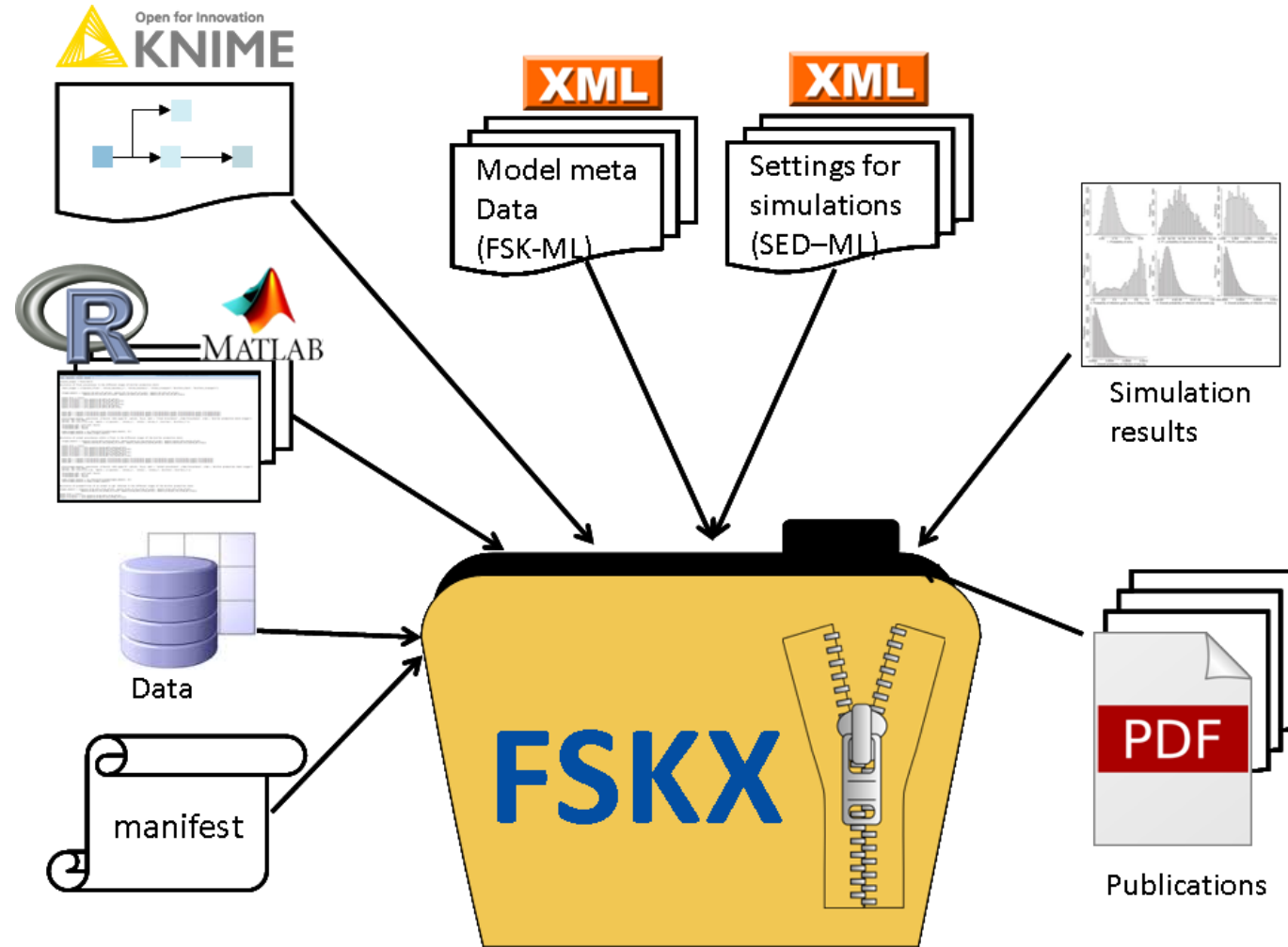
Matthias Filter (Chair)	Federal Institute for Risk Assessment, Germany
Sascha Bulik	Federal Institute for Risk Assessment, Germany
Carolina Plaza-Rodriguez	Federal Institute for Risk Assessment, Germany
Miguel de Alba Aparicio	Federal Institute for Risk Assessment, Germany

Alumni contributors:

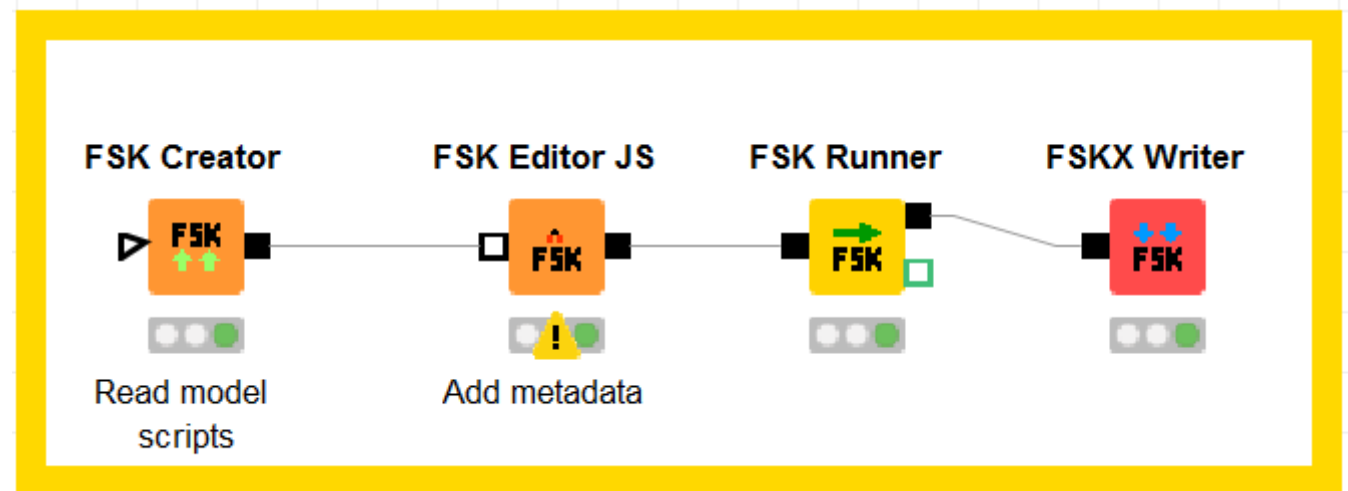
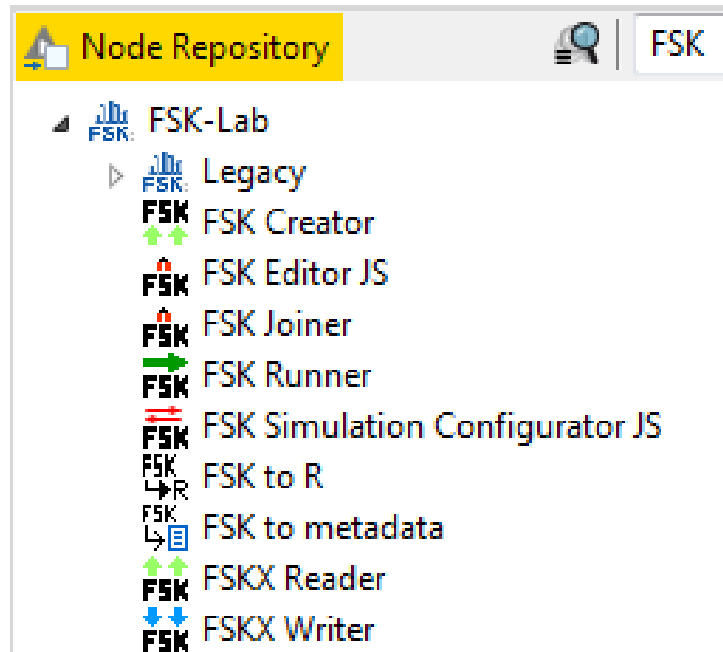
Guido Correia Carreira	Federal Institute for Risk Assessment, Germany
Alexander Falenski	Federal Institute for Risk Assessment, Germany

General Information	1	Study / Data / Model Name	1	
		Source	0:1	
		Identifier	1	
		Creator(s)	1:N	vCard 4.0 standard
		Date	1:N	Creation date
				Last modified date
		Rights	1	Rights
		Availability	1	
		URL	0:1	
		Format	0:1	
		References	1:N	Is reference description?
				Publication type
				Publication date
				PubMed ID
				Publication DOI
				Publication Author List
				Publication Title
				Publication Abstract
				Publication Journal / Vol / Issue, etc.
				Publication Status
				Publication website
				Comment
		Language	0:1	
		Software	0:1	
		Programming language	0:1	
		Model category	0:1	Model Class
				Model Sub-Class
				Model Class comment
				Basic process
		Status	0:1	
		Objective	0:1	
		Description	0:1	
Scope	1	Product / matrix	0:1	Product/matrix name
				Product/matrix description
				Product/matrix unit
				Method of production
				Packaging
				Product treatment
				Country of origin
				Area of origin
				Fisheries area
				Date of production
				date of expiry
		Hazard	0:1	Hazard type
				Hazard name
				Hazard description
				Hazard unit
				Adverse effect
				Source of contamination
				Benchmark Dose (BMD)
				Maximum Residue Limit (MRL)
				No Observed Adverse Effect Level (NOAEL)
				Lowest Observed Adverse Effect Level (LOAEL)
			0:1	Acceptable Operator Exposure Level (AOEL)
				Acute Reference Dose (ARfD)
				Acceptable Daily Intake (ADI)
				Hazard ind/sum
			0:1	Population name
				Target population
				Population Span (years)
				Population description
			0:N	Population age

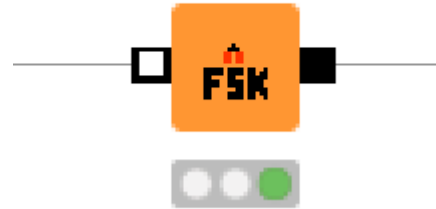
FSKX – A file format for the exchange of models (and data)



- KNIME-extension for harmonized annotation, execution and integration of script-based models
- the FSK-ML reference implementation



FSK-Lab – facilitating harmonized annotation of models



FSK Object FSK Object FSK Object

General Information Scope Data Background Model Math Model Script Visualization Script

General Information

Model Script

```
1 #rm(list
2 #the outp
3
4 #####
5 #librarie
6 #####
7 library(n
8 library(t
9 library(n
10
11 # define
12 #setwd("p
13
14
15
16
```

Fitting Procedure

Parameter

☐ Parameter

☐ Number

☐ Number

☐ Number

Study*

Study Identifier

Study Title*

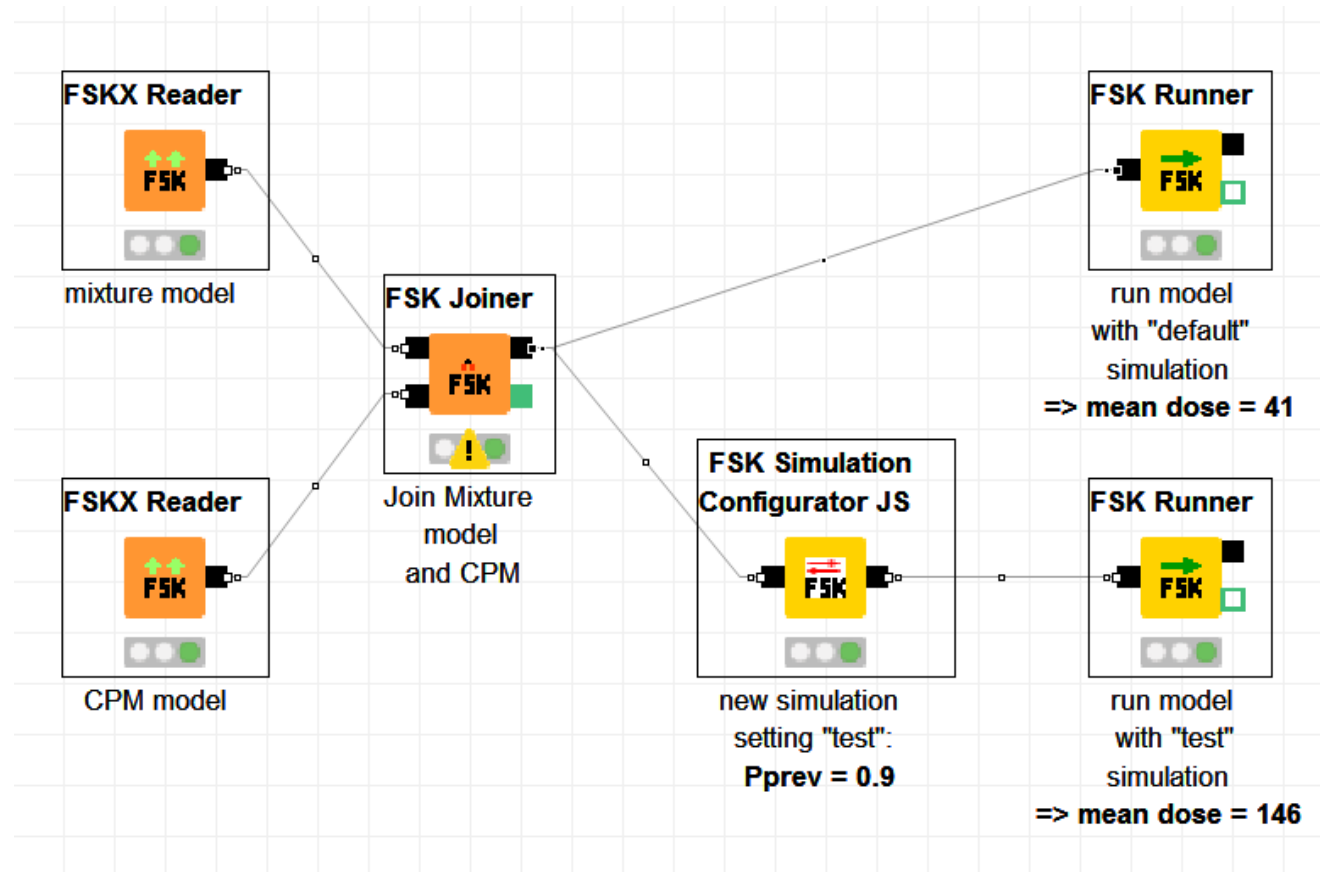
Listeria monocytogenes generic Quantitative Microbiological Risk Assessment (gQMRA) model

Study Description

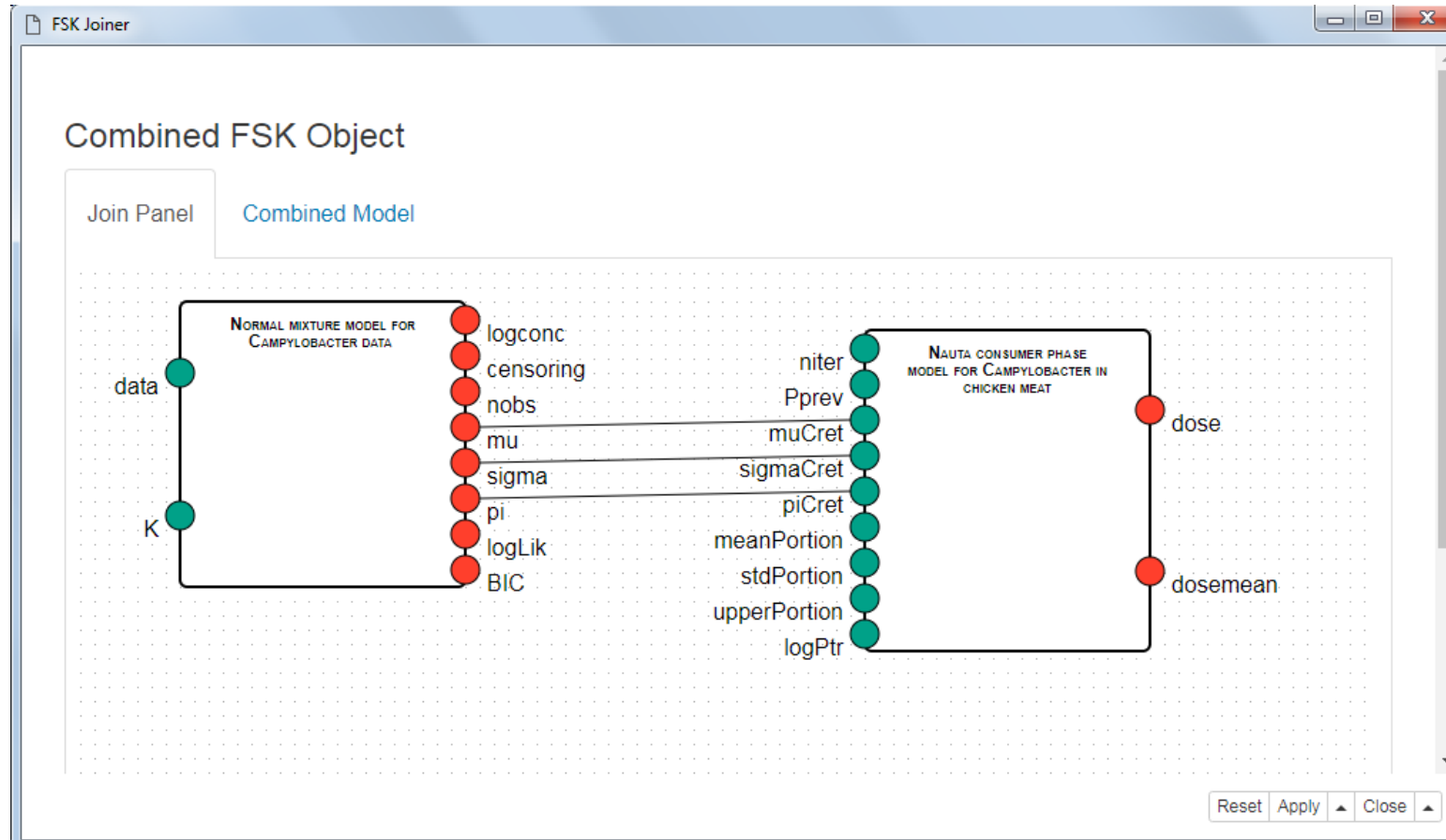
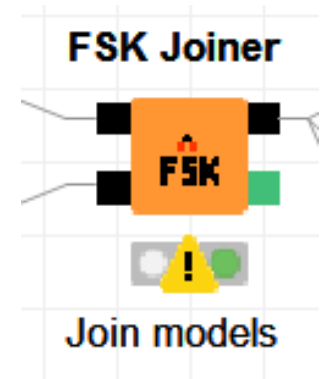
Study Design Type

Study Assay Measurement Type

FSK-Lab – supporting knowledge integration



FSK-Joiner – combining models graphically (JS)



FSK-Lab – facilitating user-defined simulations

FSK Simulation
Configurator JS



JS Simulation Configurator

Simulations

defaultSimulation

Test


Remove Enter new simulation Add

Test

data	<input type="text" value='read.csv("campy-obs-censoring.csv", head'/>	i	[]
K	<input type="text" value="1"/>	i	[]
niter	<input type="text" value="100000"/>	i	[]
Pprev	<input type="text" value="0.9"/>	i	[Probability]
meanPortion	<input type="text" value="189.0"/>	i	g
stdPortion	<input type="text" value="126.9"/>	i	g
upperPortion	<input type="text" value="1000.0"/>	i	g
logPtr	<input type="text" value="c(2.24, 2.36, 2.37, 2.58, 2.82, 2.86, 3.16, 3"/>	i	Others

Deployment

FoodRiskLabs




- FoodChain-Lab
- Predictive Microbial Modeling Lab (PMM-Lab)
- FoodProcess-Lab
- Food Safety Knowledge Lab (FSK-Lab)
- Open Food Safety Model Repository


BfR & EFSA Safety Tools

- RAKIP Web Portal
- RAKIP Model Repository & Web Services
- RAKIP Harmonization Resources
- FSK-ML (Food Safety Knowledge Markup Language)
- RAKIP Roadmap
- Predictive Microbial Modelling and QMRA Software Directory

RAKIP Web Portal



risk assessment modelling & knowledge integration platform



anses BfR DTU Food
National Food Institute

The food safety community is generating a variety of scientific knowledge (e.g. scientific publications, experimental data and mathematical models) and resources (databases and software tools for model generation and application). However, the access to this knowledge and the exchange of information between databases and software tools are currently difficult and time consuming. Therefore, three European institutions specialized in food safety risk assessment (ANSES, BfR and DTU Food) initiated a joint project to establish new community resources facilitating the efficient knowledge integration and exchange into and between IT-based applications and resources. The envisaged "Risk Assessment Modelling and Knowledge Integration Platforms" (RAKIP) will be based on harmonized data formats and consistent rules for knowledge annotation. The feasibility of this concept will be exemplified through an RAKIP Web Portal allowing users to access and download risk assessment models, modules thereof and related data in a harmonized file format. These files can then be imported and executed by software tools supporting the proposed harmonized file format. The RAKIP Web Portal therefore also contains supporting resources needed for the harmonized

RAKIP Model Repository

1_FSK_Model_Repository_Demonstrator 2019-03-20 14.19.32

RAKIP-Web FSKX Model Downloader FSKX Model Joiner Upload of Harmonized Models Online Creation of Harmonized Models

Search: Campy Your search returned 5 models

Check	Model Name	ModelID	Software Select	Environment Select	Hazard Select	Execution Time	Upload Date	Details
<input type="checkbox"/>	Brynstad consumer phase model for Campylobacter in chicken meat	CPM2011Br brynstad	R	Poultry — chicken, geese, duck, turkey and Guinea fowl — ostrich, pigeon Meat	Campylobacter jejuni	00:00:53	2018-10-19 17:44	Details
<input type="checkbox"/>	Christensen consumer phase model for Campylobacter in chicken meat	CPM181019 ristensen	R	Poultry — chicken, geese, duck, turkey and Guinea fowl — ostrich, pigeon Meat	Campylobacter jejuni	00:00:11	2018-10-19 18:10	Details
<input type="checkbox"/>	FAO/WHO consumer phase model for Campylobacter in chicken meat	CPM181019 OWH	R	Poultry — chicken, geese, duck, turkey and Guinea fowl — ostrich, pigeon Meat	Campylobacter jejuni	00:00:07	2018-10-19 18:12	Details
<input type="checkbox"/>	Nauta consumer phase model for Campylobacter in chicken meat	CPM181019 nauta	R	Poultry — chicken, geese, duck, turkey and Guinea fowl — ostrich, pigeon Meat	Campylobacter jejuni	00:00:06	2018-10-19 18:12	Details
<input type="checkbox"/>	Dose-response model for Campylobacter in chicken meat	DR20190318 sical	R	Poultry — chicken, geese, duck, turkey and Guinea fowl — ostrich, pigeon Meat	Campylobacter jejuni	00:00:03	2019-03-18 19:43	Details

Model Details

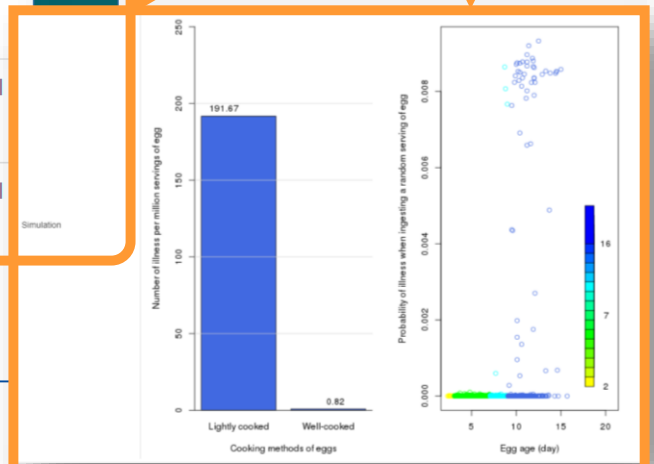
Feature	Value
Model name	ESBL E.coli in Broiler
Model id	horizontal_transmi_flocks_R
Organism	Escherichia coli o157:h7
Environment	Broiler
Model creator	Carolina Plaza-Rodríguez, Guido Correia Carreira
Software	R
Model reference description	C. Plaza-Rodríguez, H. Sharp, U. Roesler, A. Friese, A. Kaesbohrer (2015). Development of a model for the spread of ESBL/AmpC E.coli in broiler production. Poster presented at the National Symposium on zoonosis Research, Berlin, Germany
Created date	11.18.2015
Modified date	06.09.2016
Rights	Public
Notes	This module calculates how the prevalence among flocks changes due to horizontal transmission of ESBL E. coli between flocks on a given stage (hatchery, transports or broiler farm) of the modelled production chain. The impact of horizontal transmission on the prevalence among flocks is modelled by a generalized linear model.

Search for the available models

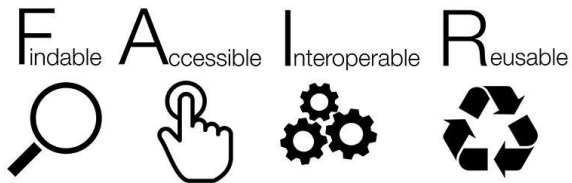
Look into model metadata

Select models

Run the models



Deployment: FSK-Lab in Virtual Research Environments (VRE)

A screenshot of the AGINFRAplusDev web application interface. The top navigation bar is green and contains links for AGINFRA+ Dev, Admin, Members, Mgmt. tools, Analytics, Semantics, and Catalogue. Below this is a secondary navigation bar with links for Discovery, Visualisation, and Write. The main content area shows a search results page for "List*". It displays 24 items found, ordered by Name Ascending. The items are listed as "Listeria Monocytogenes (DR of gQMRA)" and "Listeria Monocytogenes (Process of gQMRA)". The left sidebar shows the AGINFRAplusDev logo and a description of the Virtual Research Environment, along with statistics for Followers (0) and Items (24).

AGINFRAplusDev

This Virtual Research Environment is conceived to provide AGINFRAplus consortium members with a working environment to experience with AGINFRAplus services and develop new ones. [read more](#)

Followers 0 Items 24

[Follow](#)

Items About

List*

24 items found for "List*" Order by: Name Ascending

Types: FSKXModel

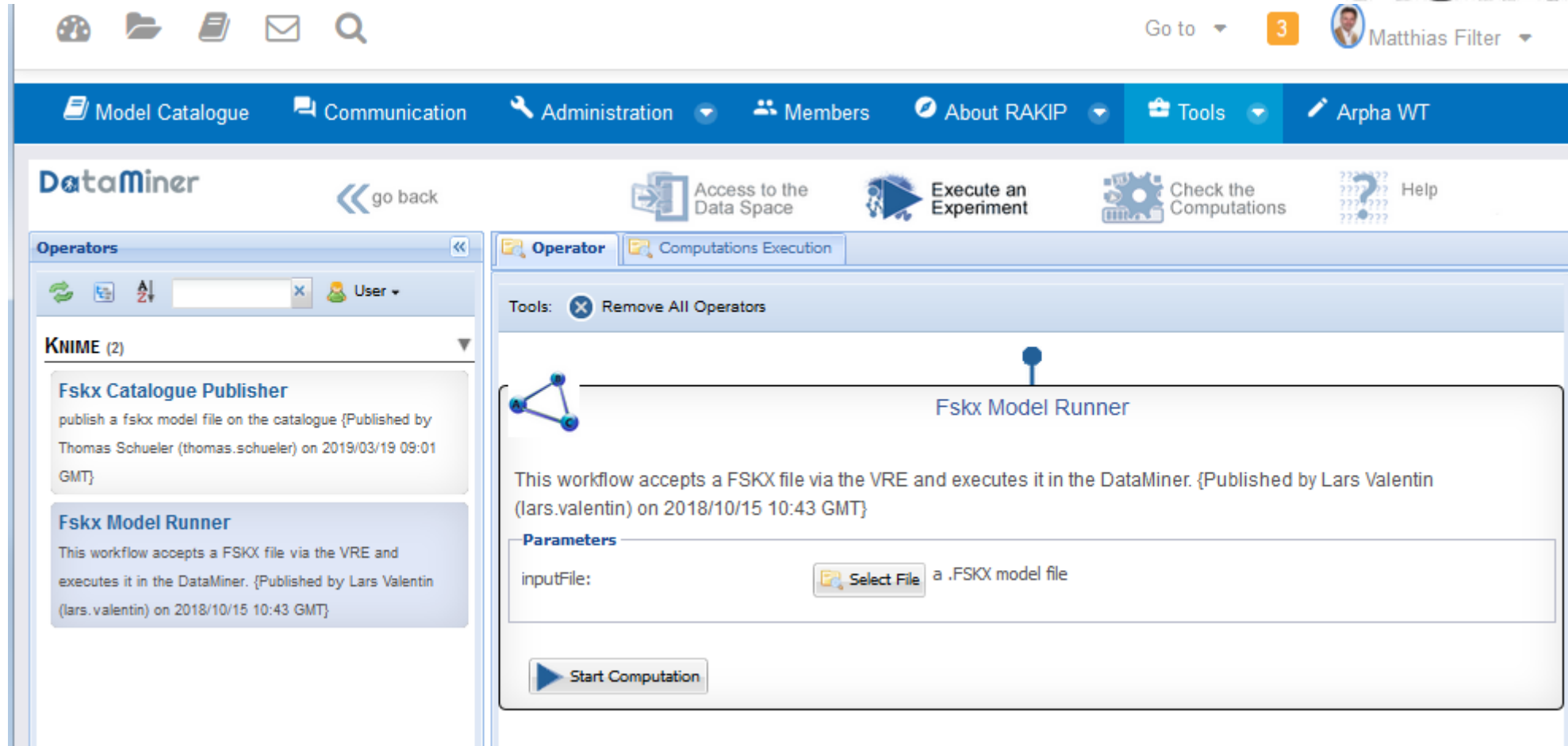
Listeria Monocytogenes (DR of gQMRA) FSKXModel

Listeria Monocytogenes (DR of gQMRA) FSKXModel

Listeria Monocytogenes (Process of gQMRA) FSKXModel

Listeria Monocytogenes (Process of gQMRA) FSKXModel

Deployment: Running KNIME WF in VREs



The screenshot displays the AGINFRA DataMiner web interface. At the top, there is a navigation bar with icons for home, folders, documents, mail, and search. To the right, it shows 'Go to' with a dropdown, a notification badge with the number '3', and a user profile for 'Matthias Filter'. Below this is a blue navigation bar with links: 'Model Catalogue', 'Communication', 'Administration', 'Members', 'About RAKIP', 'Tools', and 'Alpha WT'. The main content area has a header with 'DataMiner', a 'go back' button, and several action buttons: 'Access to the Data Space', 'Execute an Experiment', 'Check the Computations', and 'Help'. The left sidebar is titled 'Operators' and shows a search bar with 'User' selected. Under the 'KNIME (2)' category, two operators are listed: 'Fskx Catalogue Publisher' and 'Fskx Model Runner'. The 'Fskx Model Runner' operator is selected, and its details are shown on the right. The details include a description: 'This workflow accepts a FSKX file via the VRE and executes it in the DataMiner. {Published by Lars Valentin (lars.valentin) on 2018/10/15 10:43 GMT}'. Below the description is a 'Parameters' section with a table for 'inputFile:' and a 'Select File' button. At the bottom, there is a 'Start Computation' button.

Go to 3 Matthias Filter

Model Catalogue Communication Administration Members About RAKIP Tools Alpha WT

DataMiner go back Access to the Data Space Execute an Experiment Check the Computations Help

Operators

KNIME (2)

Fskx Catalogue Publisher
publish a fskx model file on the catalogue {Published by Thomas Schueler (thomas.schueler) on 2019/03/19 09:01 GMT}

Fskx Model Runner
This workflow accepts a FSKX file via the VRE and executes it in the DataMiner. {Published by Lars Valentin (lars.valentin) on 2018/10/15 10:43 GMT}

Operator Computations Execution

Tools: Remove All Operators

Fskx Model Runner




This workflow accepts a FSKX file via the VRE and executes it in the DataMiner. {Published by Lars Valentin (lars.valentin) on 2018/10/15 10:43 GMT}


Parameters

Parameter	Value
inputFile:	Select File a .FSKX model file

Start Computation


Bonus – Easy Publishing


[About Pensoft](#) [Books](#) [E-Books](#) [Journals](#) [News & Blog](#) [Contact](#)  Lyubomir Penev 


 **FMJ** Food Modelling Journal


[Start a manuscript](#)


[Articles](#) [About](#) [Focus and Scope](#) [Contacts](#) [Editorial team](#)



 Most Visited Papers

 Most Active Editors

 Most Active Reviewers


 Most Productive Authors




Food Modeling Journal (FMJ) is an innovative open access journal which facilitates the publication of mathematical models and data sets in the area of food science. The journal is focussed on submissions documenting the following outcomes of the research cycle: data, models, software, data analytics pipelines and visualisation methods relevant for modelling in food science. The journal will consider manuscripts for publication related (but not limited) to the following topics: food safety, food quality, food control, food defense, food design.

ISSN 0000-0000 (online)

Publication types: Models, Data analytics, Applied study, Data paper, Software description

Indexed: CrossRef, DOAJ, Google Scholar **Archived:** CLOCKSS, Zenodo

 [Apply to become an Editor via Editor Application Form](#)

 

This work is licensed under the Creative Commons Attribution License (CC BY 4.0)



Benefits

Modellers:

- Sharing and deploying models / model scripts / code becomes much easier, e.g. via RAKIP model repository or as supplement to your publications

Software developers:

- An open information exchange format is available and can be jointly improved
- Implementation of Machine-to-Machine communication features becomes possible

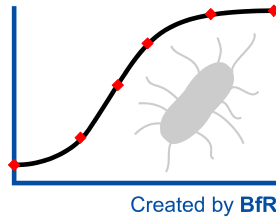
Risk assessors and researchers:

- Domain knowledge becomes more easily available and “applicable” in future risk assessments and research

Other BfR KNIME extensions

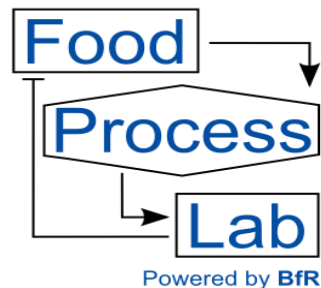
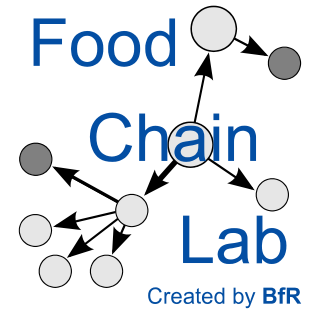
<http://foodrisklabs.bfr.bund.de/>

PMM-Lab



Predictive
Microbiology

Outbreak
Analysis
and Visualization



Food Process
Simulations

Knowledge
Exchange



Outreach



The Team



Acknowledgement and Disclaimer

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages

This work was supported by the German Federal Institute for Risk Assessment (BfR), the National Food Institute (DTU Food) from the Technical University of Denmark (DTU), the French Agency for Food, Environmental and Occupational Health & Safety (ANSES), the AGINFRA PLUS project funded by the European Commission's Horizon 2020 research and innovation programme under grant agreement No 731001, the EFSA-BfR Framework Partnership Agreement GP/EFSA/AMU/2016/01 and by funds of the Federal Ministry of Food and Agriculture (BMEL) for the project "FoodAuthent" based on a decision of the Parliament of the Federal Republic of Germany via the Federal Office for Agriculture and Food (BLE) under the innovation support programme.

The content of this talk does not reflect the official opinion of the European Union, EFSA, BMEL or BLE. **Responsibility for the information and views expressed in this talk lies entirely with the presenter.**

Thank you for your attention

Matthias Filter

Federal Institute for Risk Assessment

Max-Dohrn-Str. 8-10 • 10589 Berlin, GERMANY

Tel. +49 30 - 184 12 - 24109 • Fax +49 30 - 184 126 - 24109

matthias.filter@bfr.bund.de • www.bfr.bund.de