Harnessing the power of data – veterinary perspective

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Photo: Boys in Bristol Photography

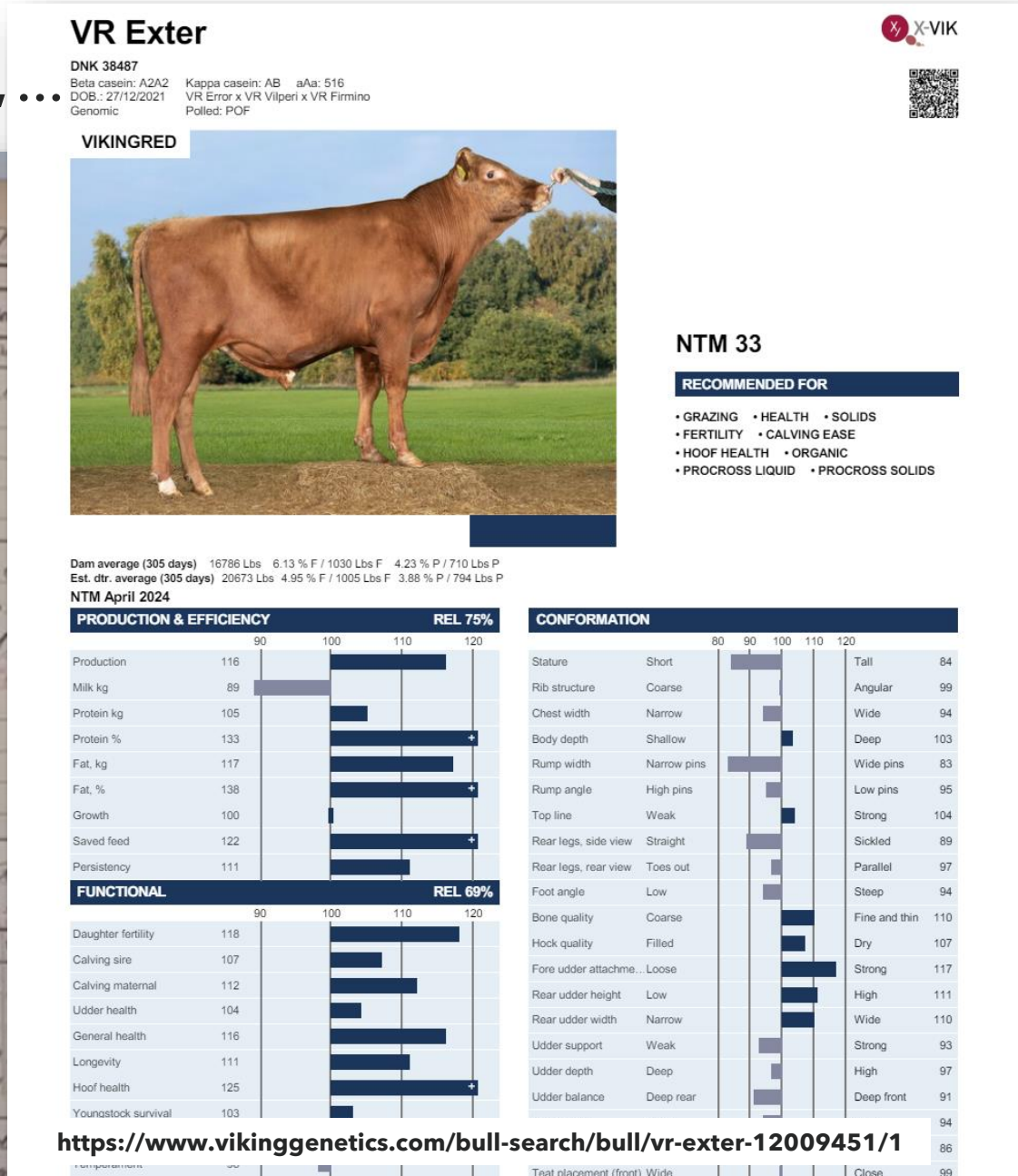
Photo: Barry Skeates

Starting point

Production

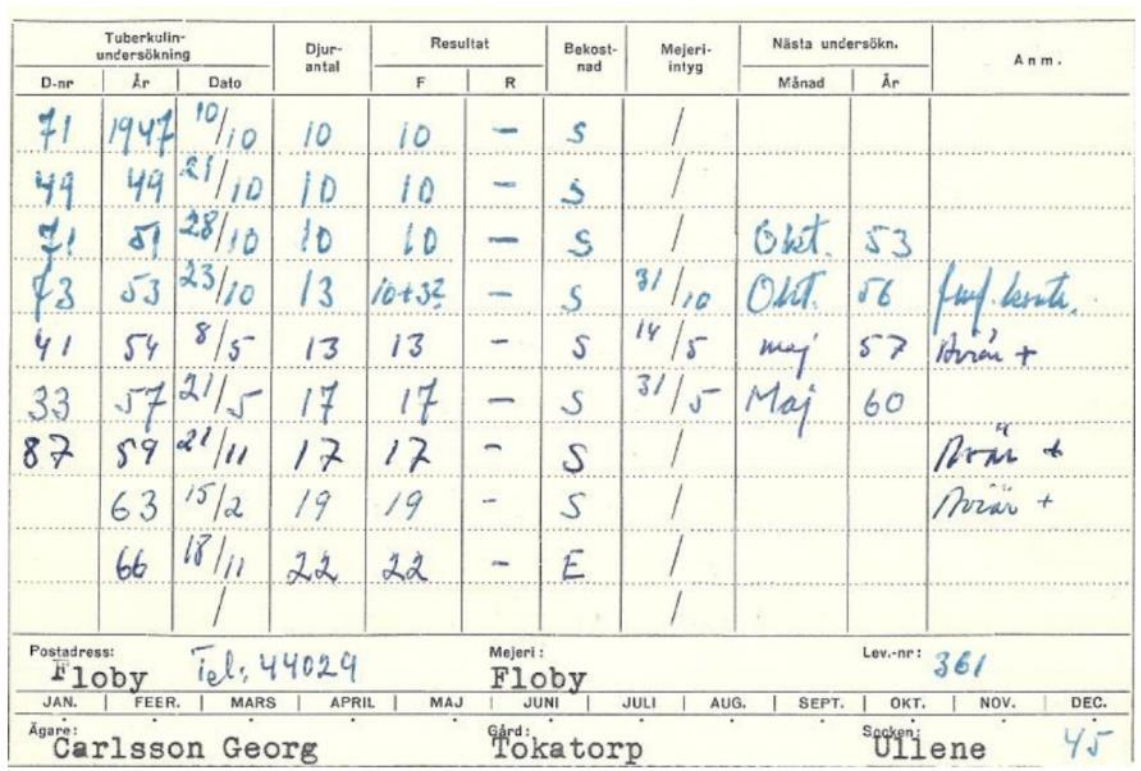
Keeping track of animals, their results, treatments, …

https://www.vxa.se/mjolkproduktion/kokontrollen-125-ar/



https://www.vikinggenetics.com/bull-search/bull/vr-exter-12009451/1

Collecting data in disease control programme



Tuberkulin-undersökning D-nr	Tuberkulin-undersökning År	Tuberkulin-undersökning Dato	Djur-antal	Resultat F	Resultat R	Bekost-nad	Mejeri-intyg	Nästa undersökn. Månad	Nästa undersökn. År	Anm.
71	1947	10/10	10	10	–	S	/			
49	49	21/10	10	10	–	S	/			
71	51	28/10	10	10	–	S	/	Okt.	53	
73	53	23/10	13	10+3?	–	S	31/10	Okt.	56	[illegible]
41	54	8/5	13	13	–	S	14/5	maj	57	Avrär +
33	57	21/5	17	17	–	S	31/5	Maj	60	
87	59	21/11	17	17	–	S	/			Avrär +
	63	15/2	19	19	–	S	/			Avrär +
	66	18/11	22	22	–	E	/			
		/					/			

Postadress: Floby Tel: 44029 Mejeri: Floby Lev.-nr: 361

JAN. | FEER. | MARS | APRIL | MAJ | JUNI | JULI | AUG. | SEPT. | OKT. | NOV. | DEC.

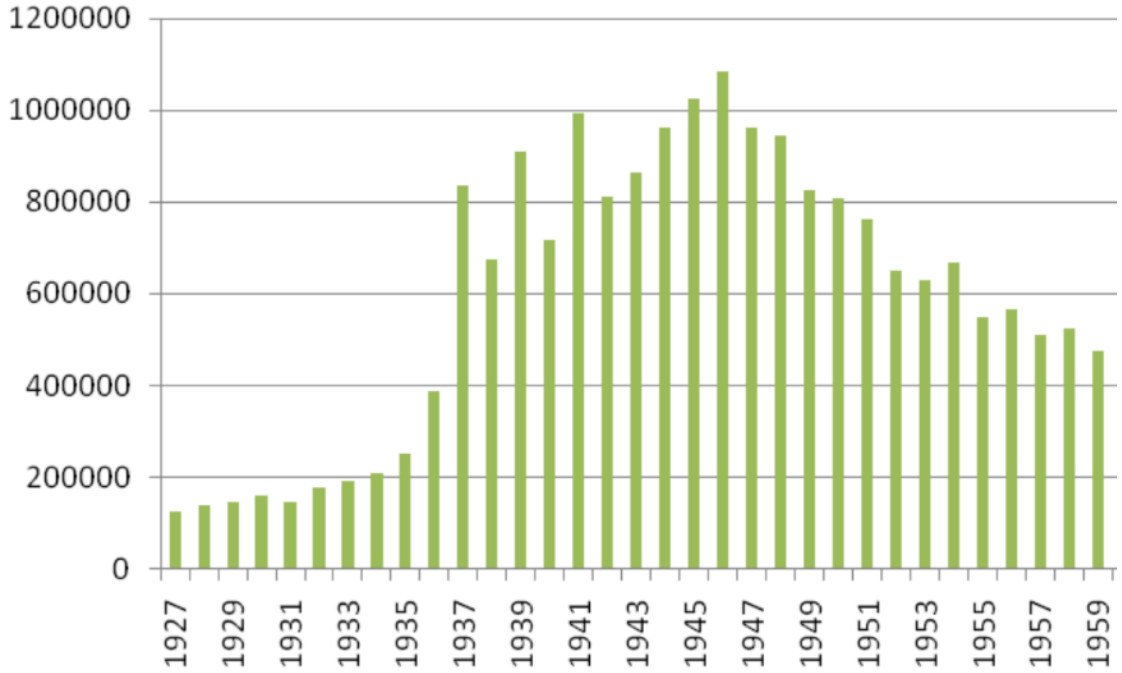
Ägare: Carlsson Georg Gård: Tokatorp Socken: Ullene 45

Photo: Paul Lindgren, 1952

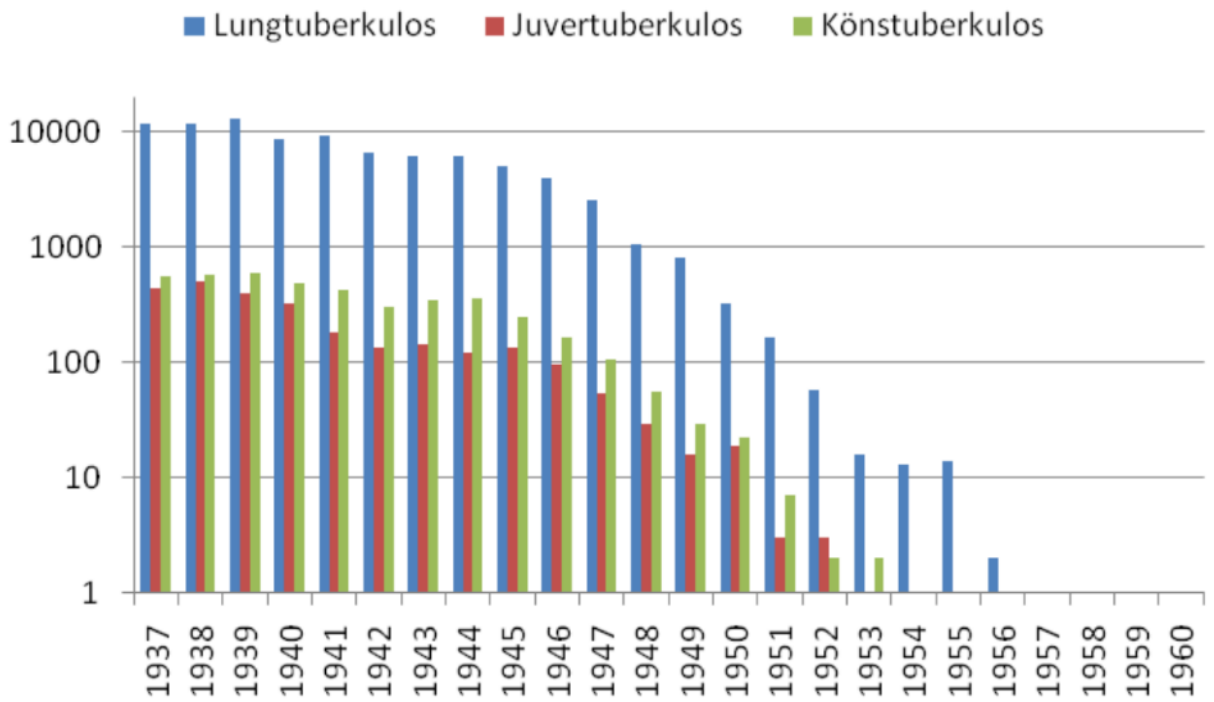
Control card to the left, from https://cerenius.se/onewebmedia/Folke/Veterin%C3%A4r%20smittskyddshistoria/Smittskyddets%20historia%20Rapport.pdf

Visualisation of data to follow up on results

Tuberculin testing in cattle



Cases of tuberculosis in cattle



Graphs from https://cerenius.se/onewebmedia/Folke/Veterin%C3%A4r%20smittskyddshistoria/Smittskyddets%20historia%20Rapport.pdf

Contrasting conditions/trends

NOVA

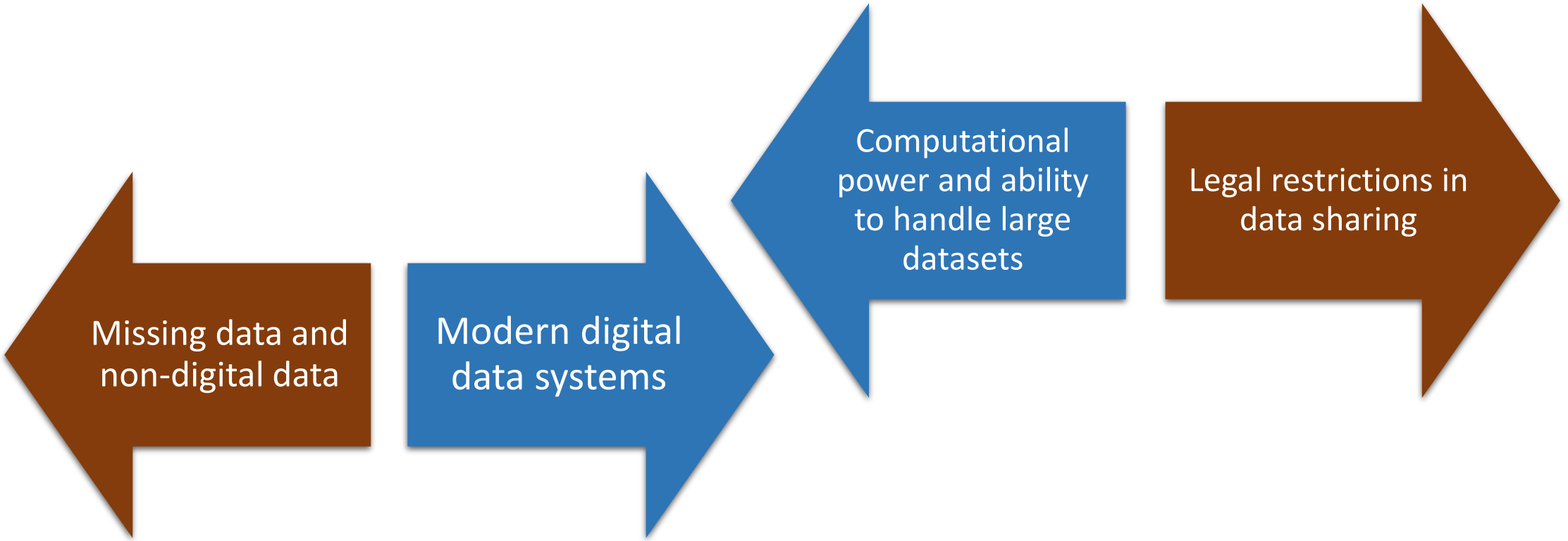
Novel approaches for design and evaluation of cost-effective surveillance across the food chain

This presentation is part of the European Joint Programme One Health EJP. This programme has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.

Selected Outputs and Outcomes

Data availability and access

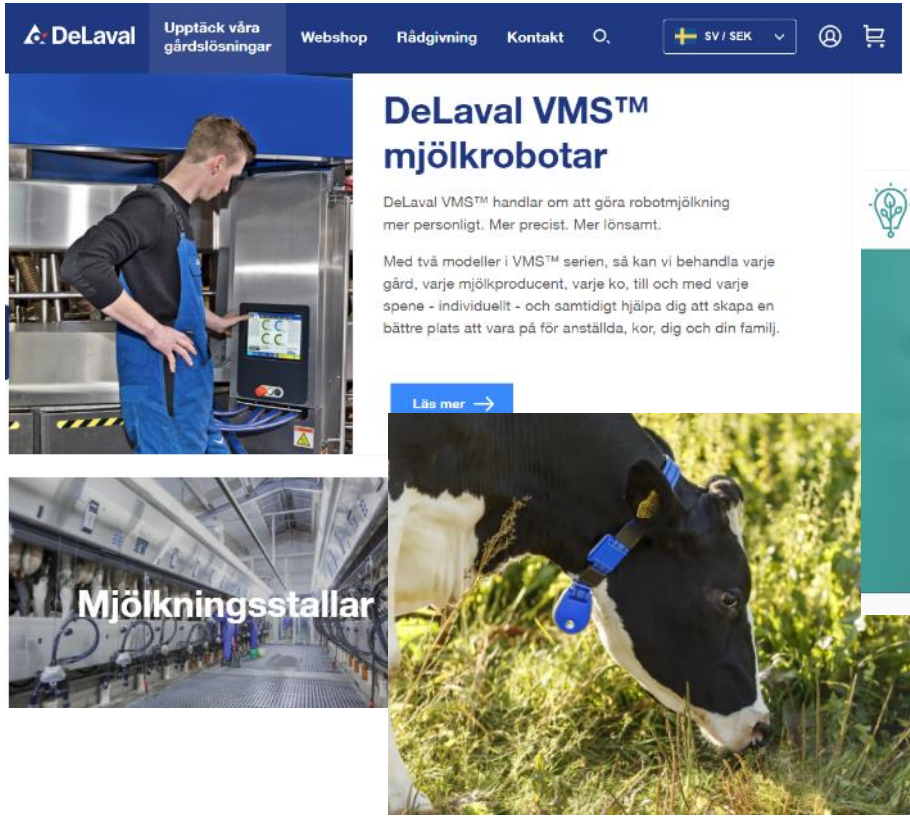
- Difficulty to share data, also between authorities in the same MS
- Imbalance in data and data access



Contrast 1

- High tech, sensors, robots
- Data from machines/equipment
- Machine learning/AI

- Still basic
- Biological, live animals, individuals
- Rural, sometimes remote



https://www.delaval.com/sv/utforska/mjolkning/

https://smartagritech.se/

Contrast 2

- Big initiatives
- Multinational databases and platforms
- Large databases, big data
- Detailed data, down to the genome

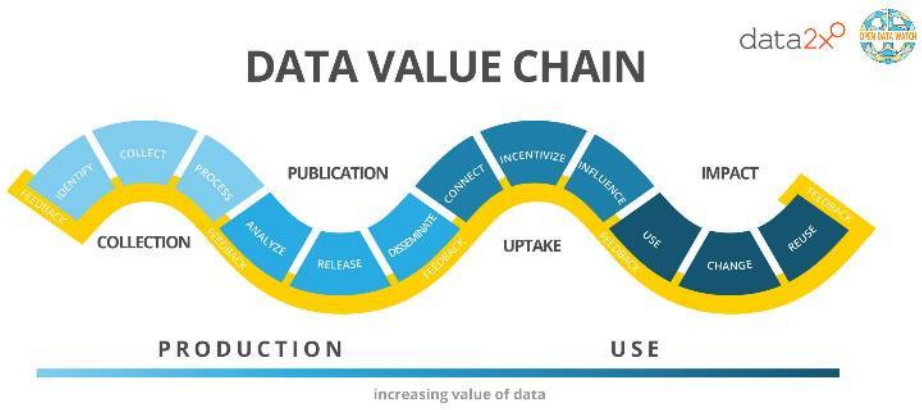
https://webbshop.kottforetagen.se/product/31145

- Small/simple tools
- Analogue solutions still in use (stable log/overview), non-digital data
- Local solutions
- Missing information and poor registering

Contrast 3

- Open data
- FAIR data
- Willingness to share

"But data are inherently a public good. Once they have been produced they can be used and reused at little cost, generating value each time. And so, our goal should be to use and reuse data to their maximum effect." *Open Data Watch*



https://opendatawatch.com/publications/the-data-value-chain-moving-from-production-to-impact/

- Uncertainties about legislation, GDPR
- Data security demands
- Worry that data will be misunderstood, misused, fear of journalists, activists, threats, bad reputation

https://www.gp.se/nyheter/gp-granskar/bondens-dotter-7-de-sager-att-de-kanske-ska-doda-mamma.c2e3bc00-7f97-4d4c-8f70-ac94439ea2f1
Vegan activists 'threatening' farmers - BBC News, 29 jan 2018 https://www.youtube.com/watch?v=rfLBvU8sSWw
https://www.hoosieragtoday.com/2024/01/03/animal-rights-activists-remain-a-serious-threat-to-your-farm/

Data owner and data user

DE CIDE

Data-driven control and prioritisation of non-EU-regulated contagious animal diseases

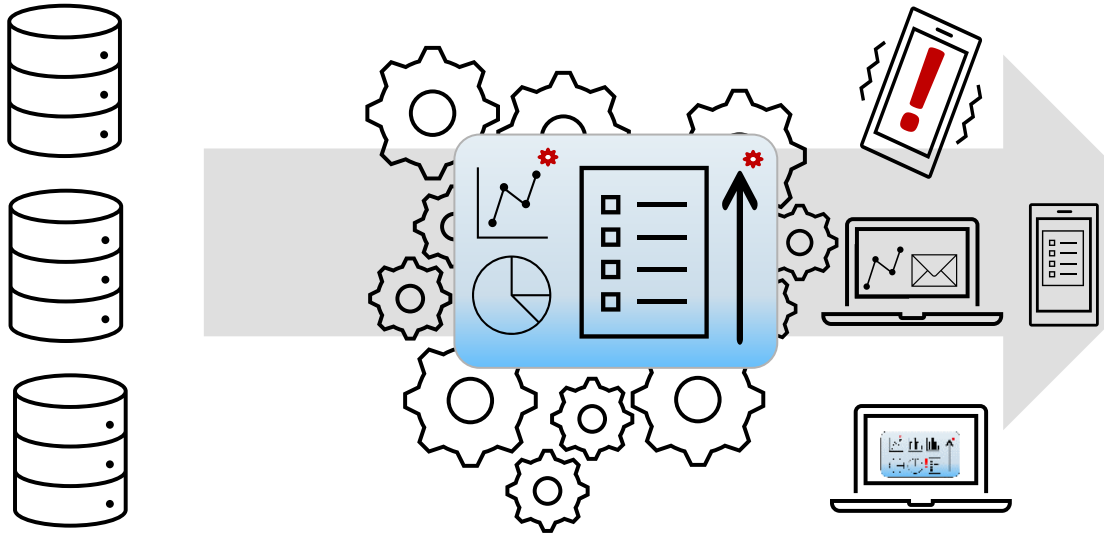
Photos: SVA

ONGOING PROJECT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101000494.

Integration of data tools

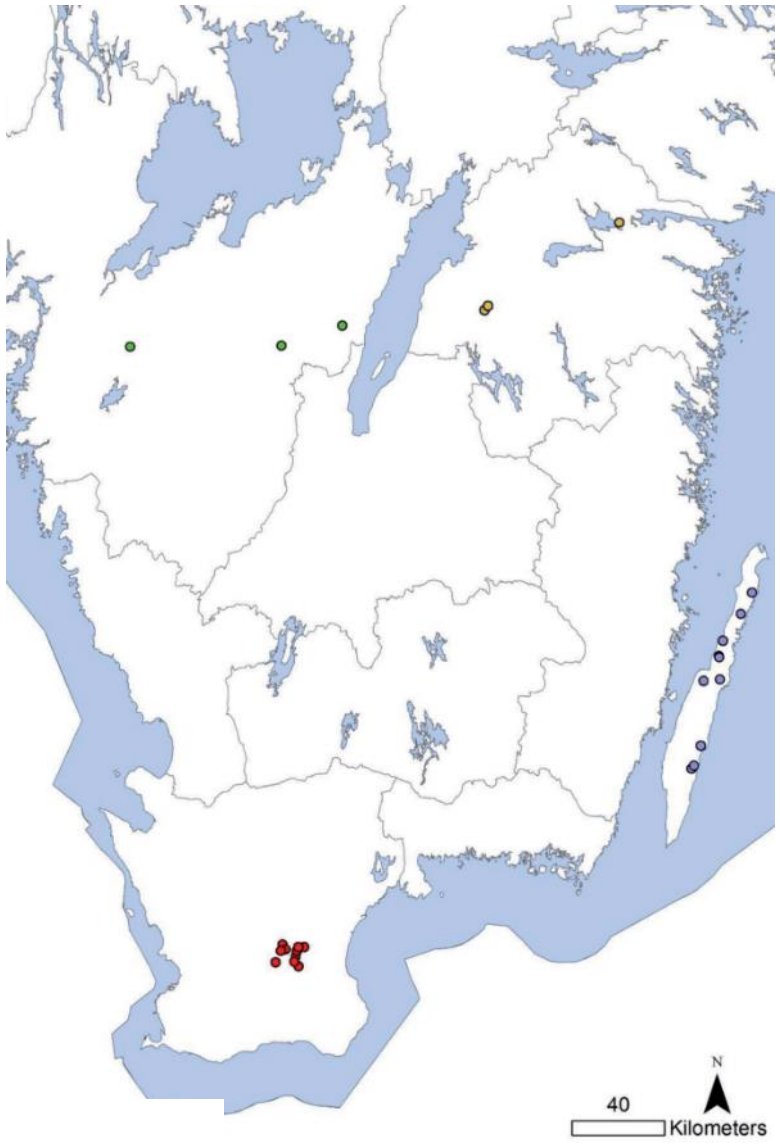
DATA

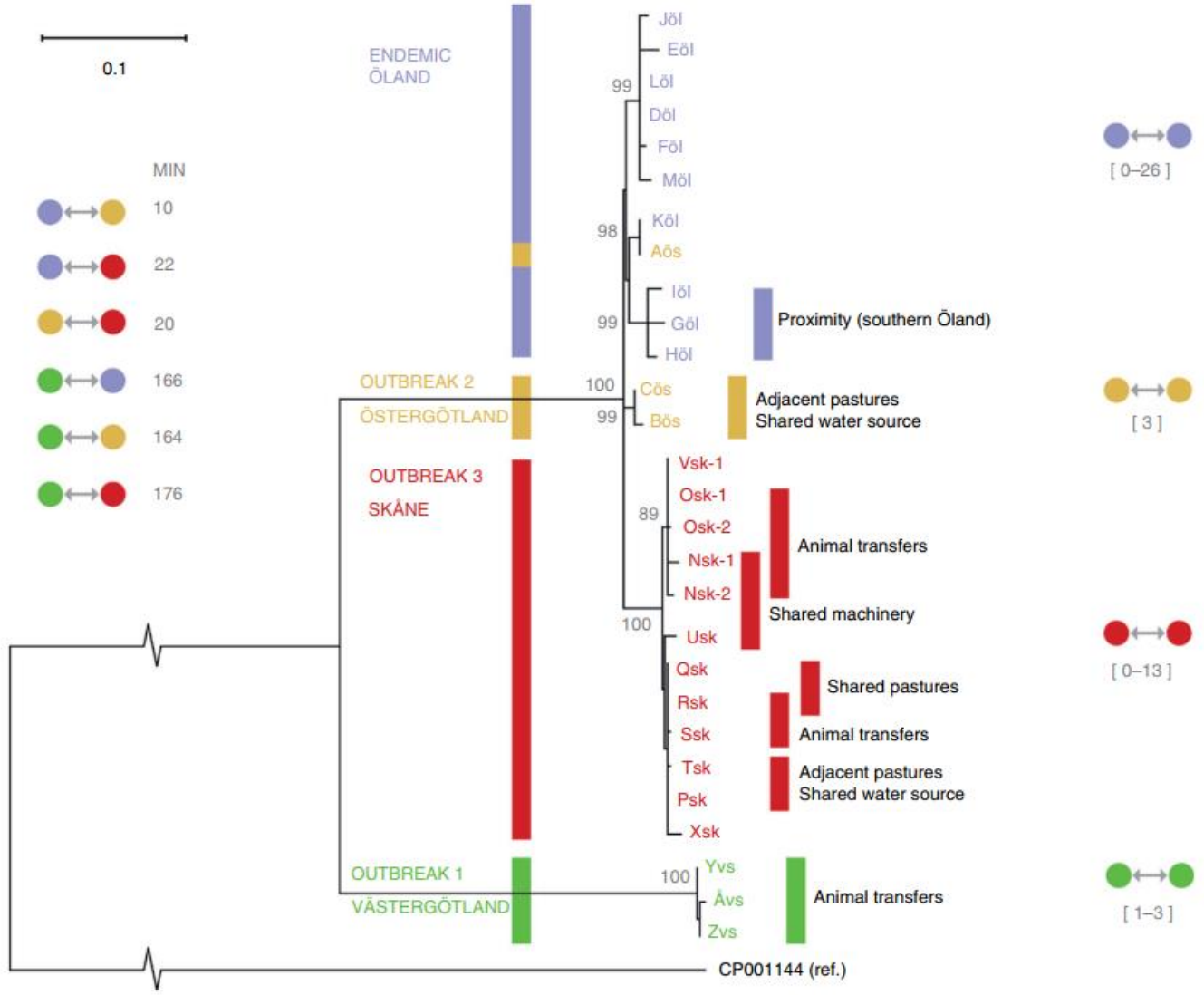


USERS

DECISIONS

Use of detailed data, whole genome sequencing

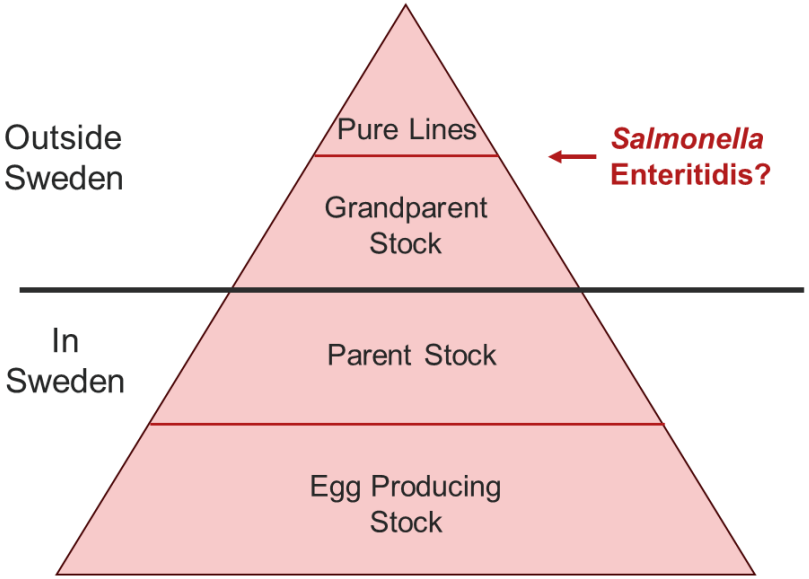


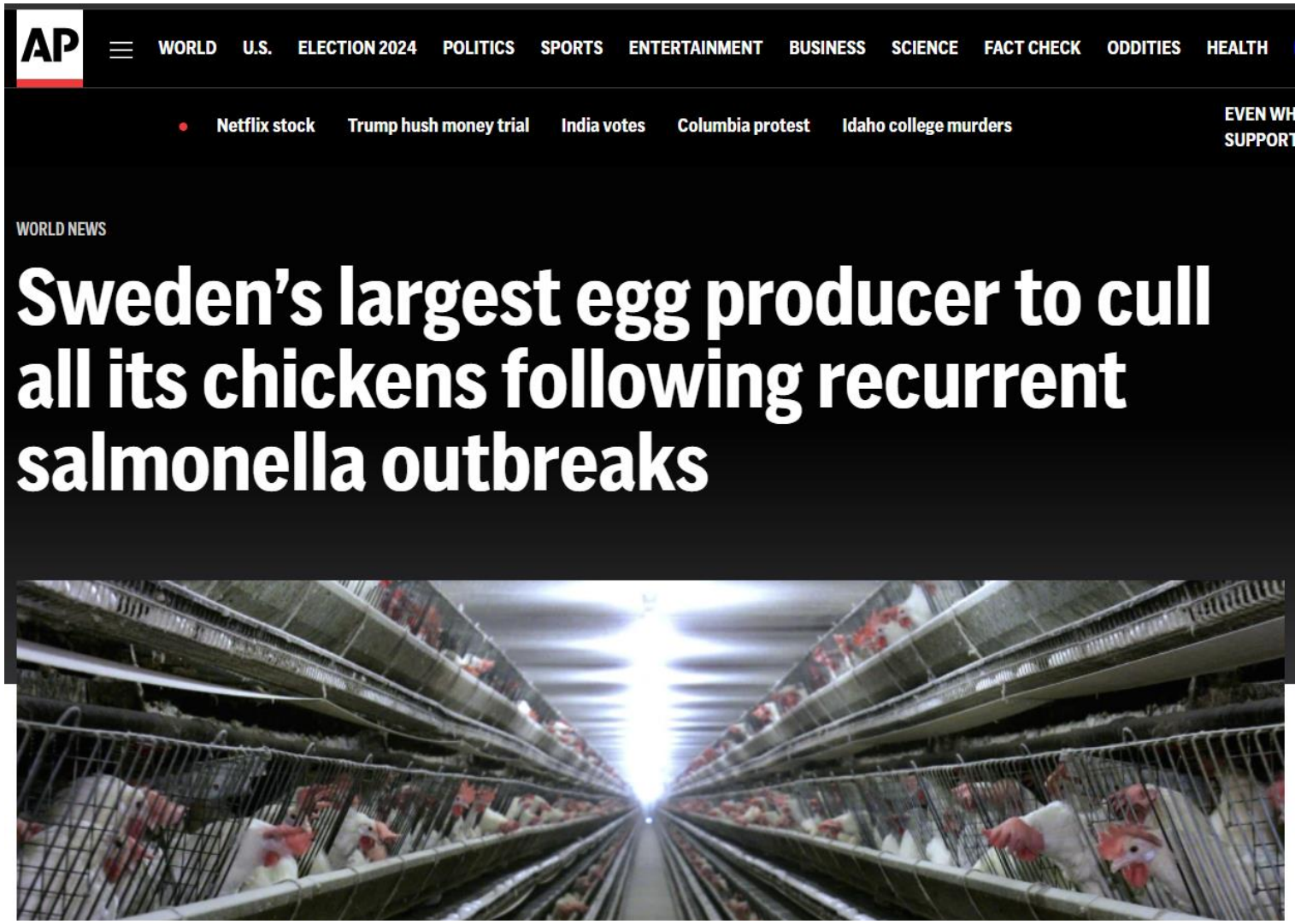


Ågren et al, Infect Ecol Epidemiol. 2016, doi: 10.3402/iee.v6.31782

Sharing data

Production pyramid in the laying hen industry





STOCKHOLM (AP) — Sweden's largest egg producer, which had nearly 1.2 million chickens or 20% of all laying hens in the country before a salmonella outbreak, has been ordered to euthanize all of them so the facility can be fully cleaned.

https://apnews.com/article/sweden-chicken-farm-salmonella-outbreak-cull-1c718dfbaa8499551a32675057a30861

Photo: SVA

Users in the field where data is registered

"We send all of our treatment data to the Board of Agriculture, and we get nothing back. It's like a black hole. I would like to have a dashboard with the data so I can use it for follow-up discussions with the farmer."

Veterinary practitioner, Sweden.

Data and technology use on farm – farmers' perspective

Several recent and ongoing studies with focus groups, interviews and tool evaluations with farmers.

TABLE 2 Summary of the themes.

Theme	Description
Extending the self	Farmers' concepts of their self-identity extend to the way they manage their animals and the data they produce
Sense of agency	Farmers value their experiential knowledge, affective relations with their animals, and their ability for abductive reasoning
Quantifying animals	Technologies generate new quantitative knowledge about animals' behaviour which forms new norms that animals adhere to at the individual, group, and herd level
Managing human labour	Technology that collects data on farm workers and animals is used as a surveillance technique to manage the workers. It can also facilitate collaboration between people on the farm

From Social and ethical implications of data and technology use on farms: a qualitative study of Swedish dairy and pig farmers Doidge et al, Frontiers in Veterinary Science 2023

Data use and data sharing – farmers' perspectives

"What I find most with my data is that it really helps protect your cows and your herd really. … The best part about being a dairy farmer is the cows and the cows are basically everything to me and I will do whatever to make sure that they are the number one really"

Dairy farmer, UK

This and the following examples come from:

- Doidge et al. Social and ethical implications of data and technology use on farms: a qualitative study of Swedish dairy and pig farmers. Frontiers in Veterinary Science 2023
- Doidge et al. A living lab approach to understanding dairy farmers' needs of technologies and data to improve herd health: Focus groups from 6 European countries. Journal of Dairy Science 2024.
- Ongoing work in DECIDE

Data use and data sharing – farmers' perspectives

"Here it comes down to the eye, and to somehow combine both what we have written down but also figure it out with a veterinarian … because there are no clear directions here on what to do."

Pig farmer, Sweden

"I think it's difficult to integrate technology because it depends on your eye for the animals. All of you here know this. Certain things you need to do by hand when pigs are being born and such. It's hard to have a robot for this."

Pig farmer, Sweden

Data use and data sharing – farmers' perpctives

"It's not entirely clear who has access to this information and who should have it. There's a bit of question mark, maybe over who does actually look at this information… and there could be someone analysing if from afar that maybe shouldn't be."

Cattle farmer, Ireland

"You have to be present, and you need to remain focused. To not relax, thinking that technology will solve it all. This will always be a potential danger."

Dairy farmer, Norway

Data use and data sharing – farmers' perspectives

"I don't want this in an app, I want to talk to my vet." Dairy farmer, Sweden

"I feel that half of the data we collect ourselves is useful. … I feel that a lot of data registered here is completely meaningless considering its value and the actual management." Dairy farmer, Norway

Data use and data sharing – farmers' perspectives

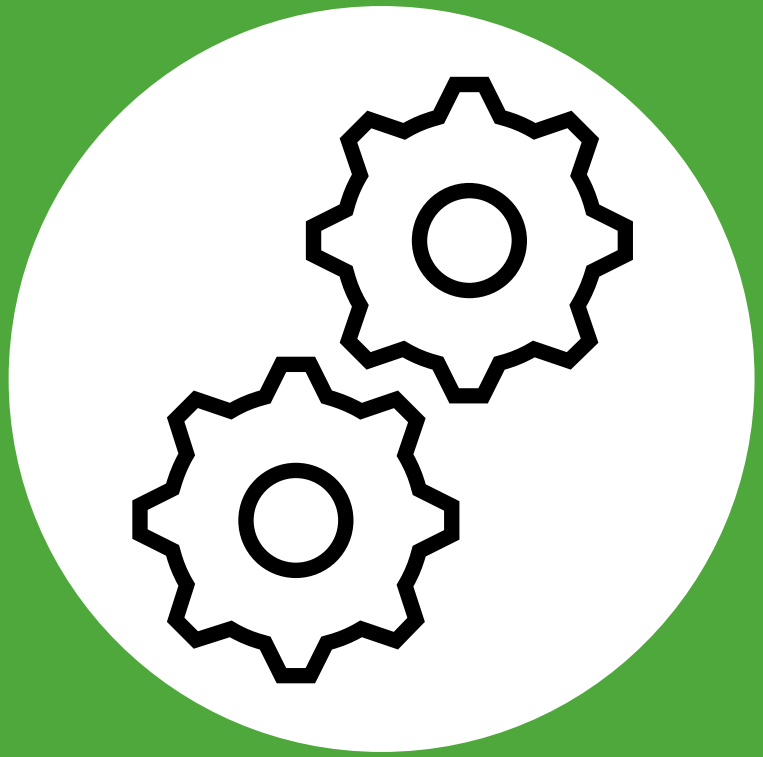
"When I take a bottle or a package of something out of the vets, I don't understand how data can't automatically show up on my end somewhere on some database that it doesn't have to do away with these prescriptions because I think they're just a total nightmare". Cattle farmer, Ireland

"Any management system or technology that you have to switch to always takes a lot of energy and time, so that was unpleasant." Cattle farmer, The Netherlands

"You want everything to talk to each other. 'Agri-cam', 'My Farm'… It's annoying that they [the apps] can't talk to each other. You are drowning with apps." Dairy farmer, Sweden

Data of relevance for veterinary sector?

AMR-data	Antibiotic usage data	Health records	Population data
Geographical information (GIS)	Biosecurity and control programmes	Production and reproduction	Costs and consequences
Environment	Wildlife	Vectors	Public health data



Tools and apps

PROGRAMMES

ANIMAL HEALTH IRELAND TRAINING

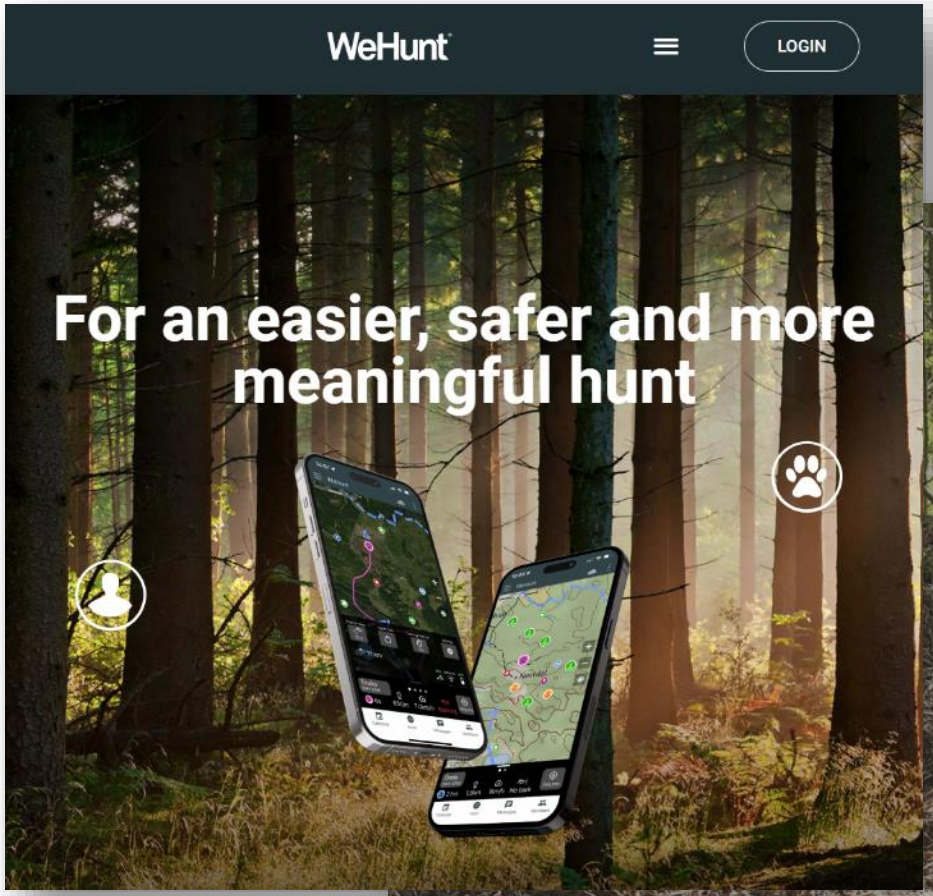
Animal Health Ireland provides the knowledge, education and coordination required to establish effective control programmes for non-regulated diseases of livestock.

FIND OUT MORE

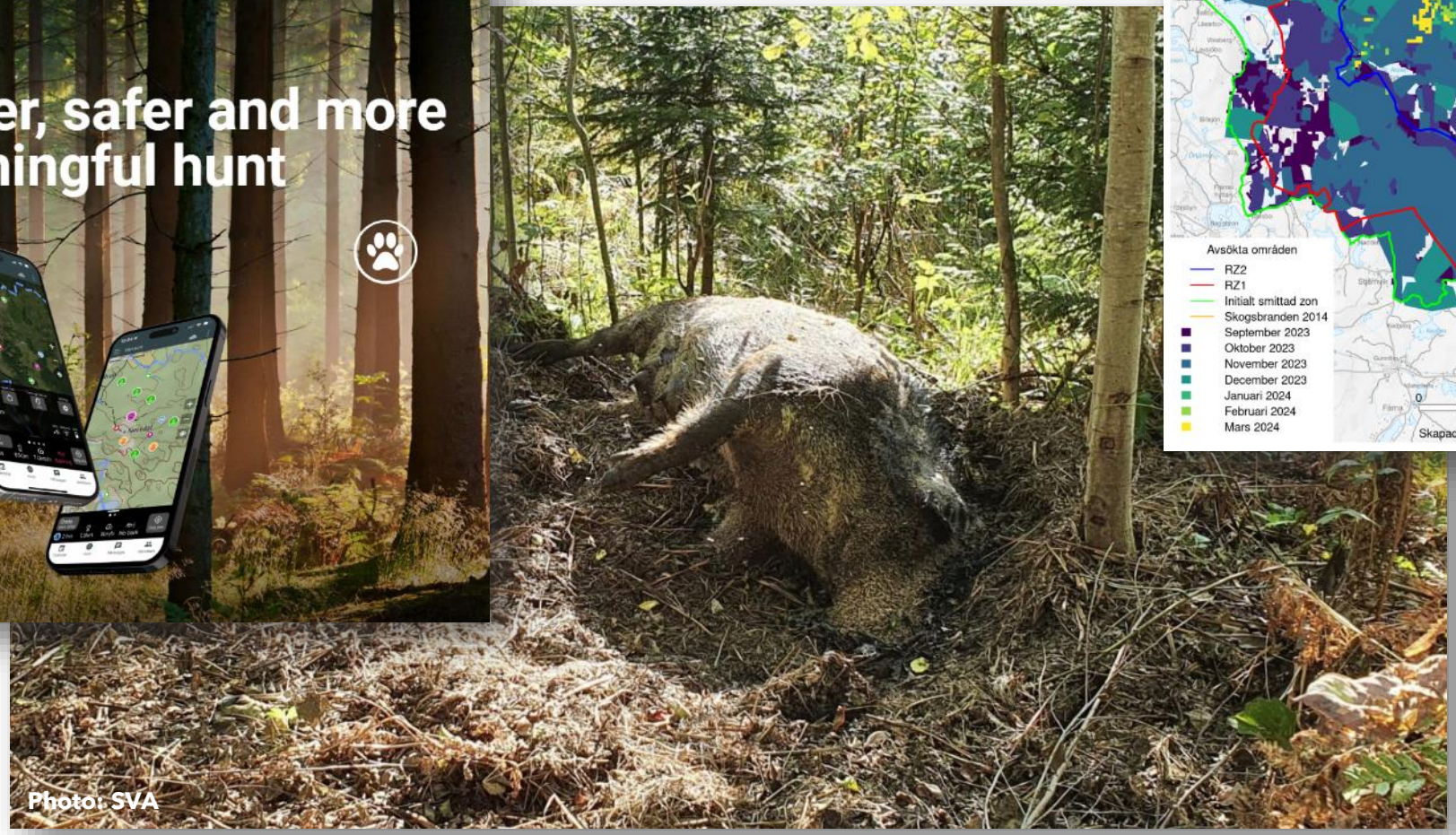
CATTLE INFORMATION

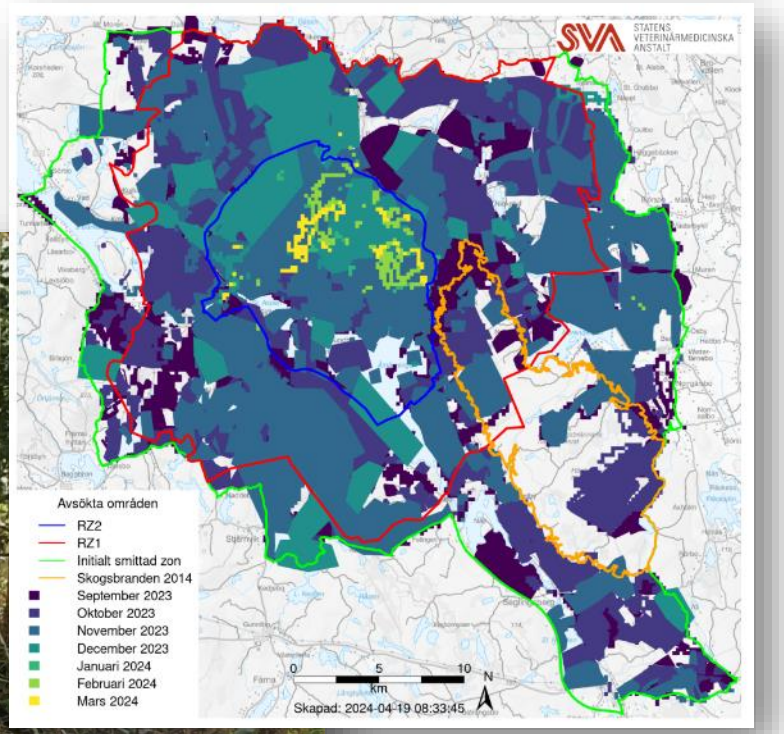
https://animalhealthireland.ie/

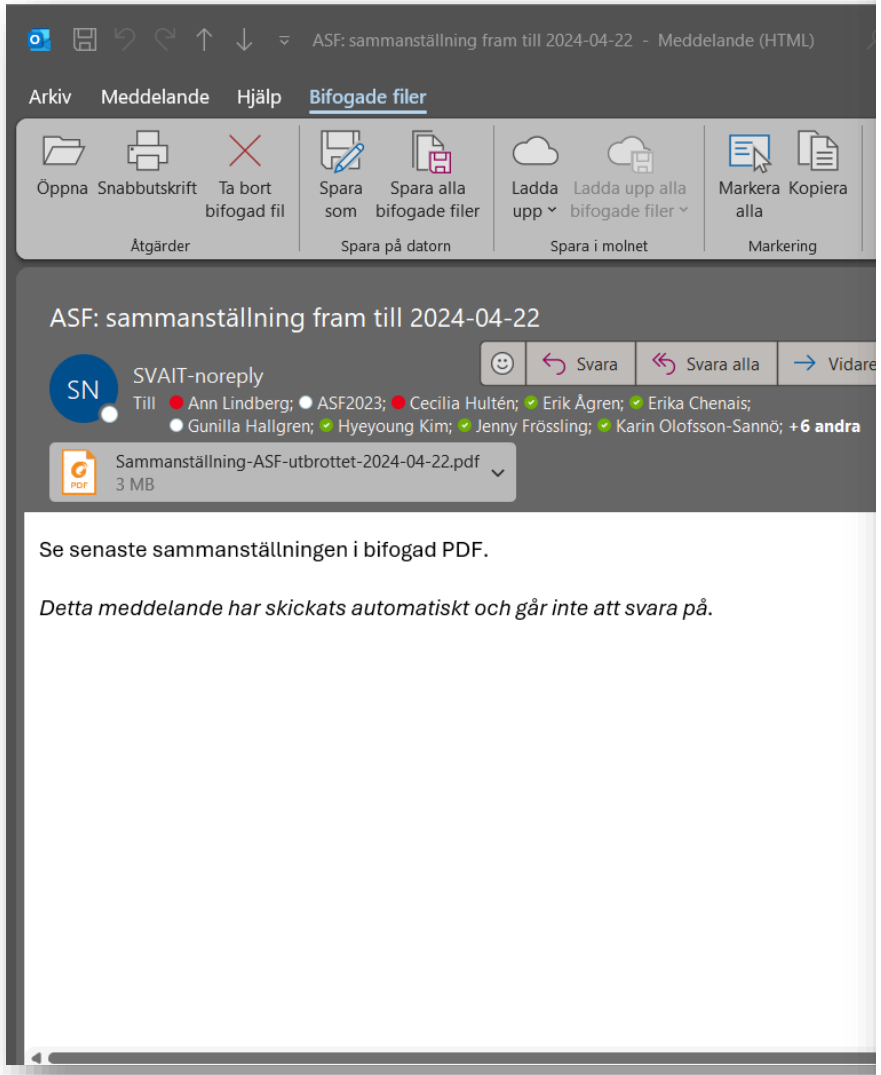
The rough, dirty, smelly, and messy reality



https://wehunt.app/



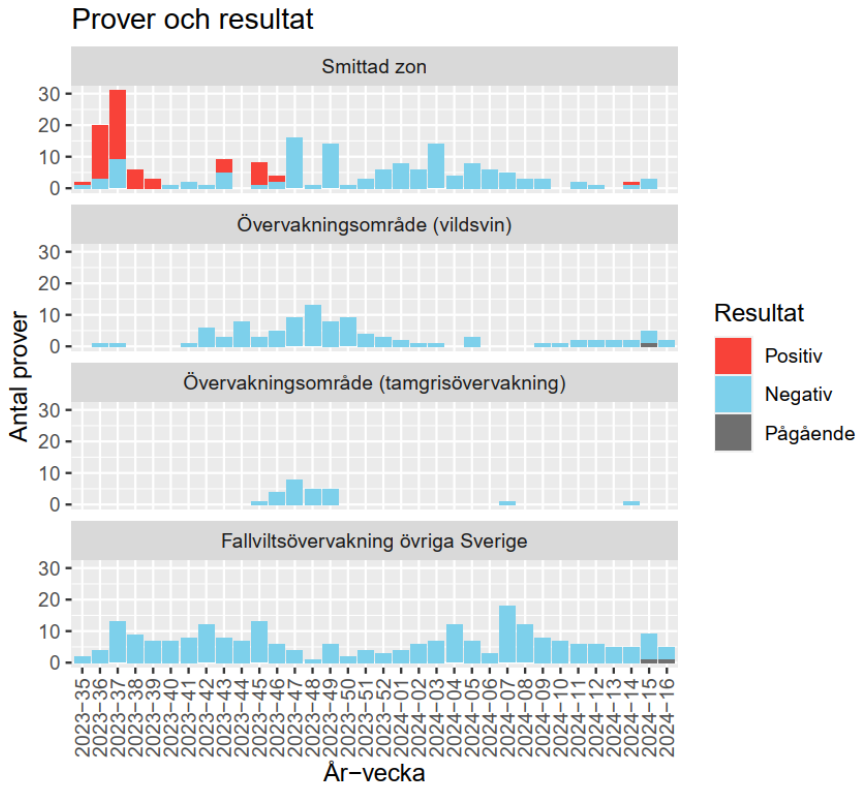




Sammanställning av data i ASF-utbrottet

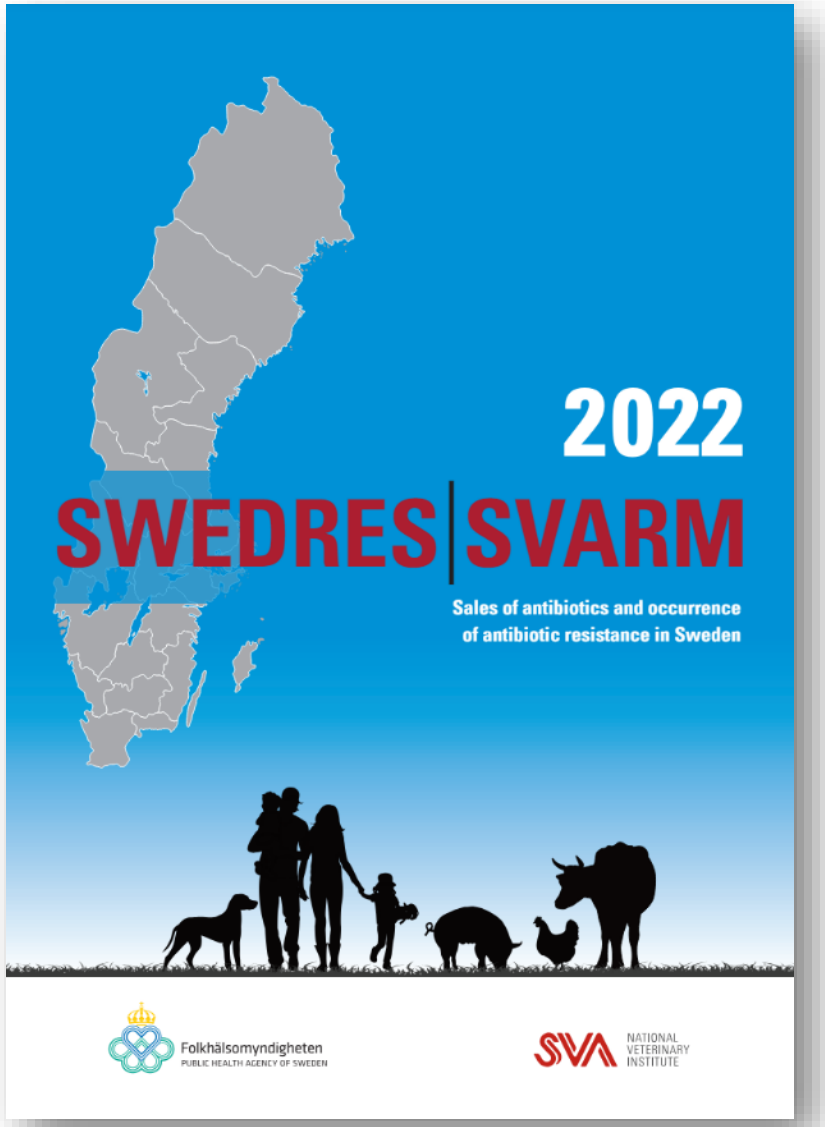
Statens veterinärmedicinska anstalt (SVA)

22 april 2024



Kategori	Positiv	Negativ	Pågående
Kadaver i smittad zon	63	34	0
Avlivning i smittad zon	0	88	0
Trafikskadade i smittad zon	0	8	0

SVARM AMR Surveillance in Sweden



Swedish Veterinary Antimicrobial Resistance Monitoring

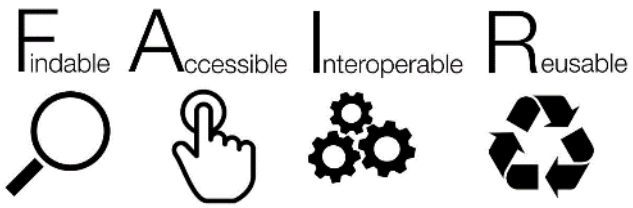
"…follow and analyse the development of antibiotic resistance among microorganisms in animals and food."

Joint report with the Public Health Agency of Sweden

- Human health aspects
- Animal health aspects

- Antibiotic sales
- Antibiotic resistance

SvarmIT



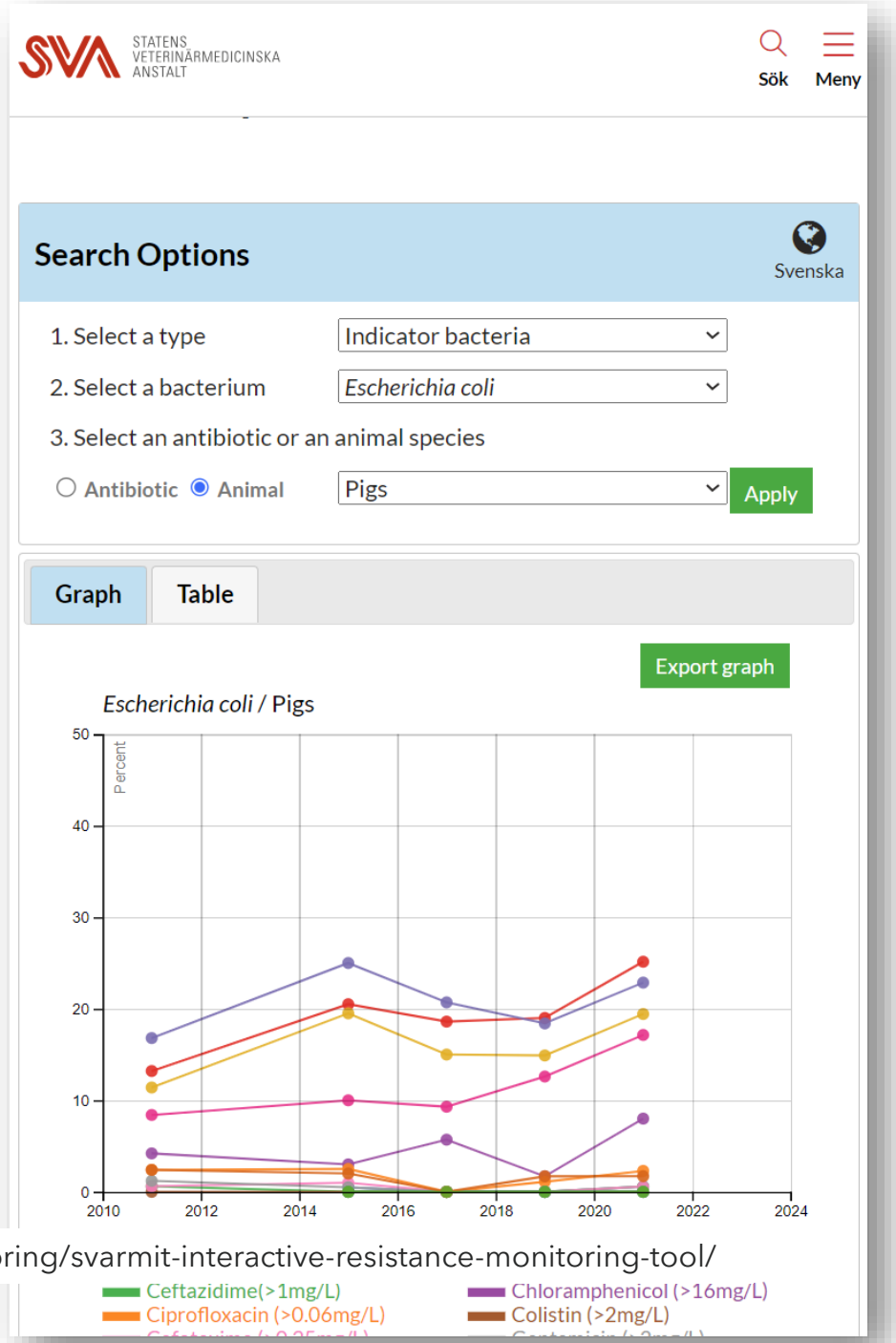
Platform for a real-time visualisation of AMR trends in animals in Sweden

Tool for timely actions – within SVA, clinicians

Expendable workflow written with open-source software

- Bacterial species
- Animal species
- Antibiotics

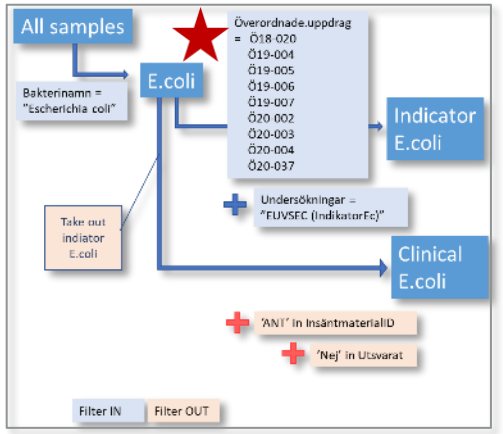
SvarmIT



https://www.sva.se/en/what-we-do/antibiotics/svarm-resistance-monitoring/svarmit-interactive-resistance-monitoring-tool/

SvarmIT

Behind the scene...



Raw data

- Take only necessary columns
- Rename some columns with Swedish characters

Filtering 1

- By **Bakterinamn**
- Rename some bacteria so AMR recognizes correctly

Filtering 2

- By **Djurslagkod**
- Classify into 7 animal species

- Take only the phenotypic test result (Suscept_Molecular==1)
- Remove the ones without MIC (Resultat)
- Remove the ones tested with 'EUVSEC2'

Analysnamn ="Penicillinastest"

Cleaning & Formatting

- Format MIC (Resultat), antibiotics (Analysnamn)
- Run AMR package: as.mic(), as.ab(), as.mo()
- Make a column for Urin using Material
- Make the data into a wide format

Breakpoint file

RS calling & Collapsing by isolate

- Run AMR package: as.rsi()
- Remove columns that have only NA and those with Analysnamn="Florfenicol"
- Collapse by 'Ingåendeundersökningsid'
- Add year using UppdragID

RS calling

Classification

- Assigning 'Type (species)' based on different criteria for each bacterium.
- Remove those that don't fit

Results_showing file

Also when Bacterinamn and Djurslagkod gets added

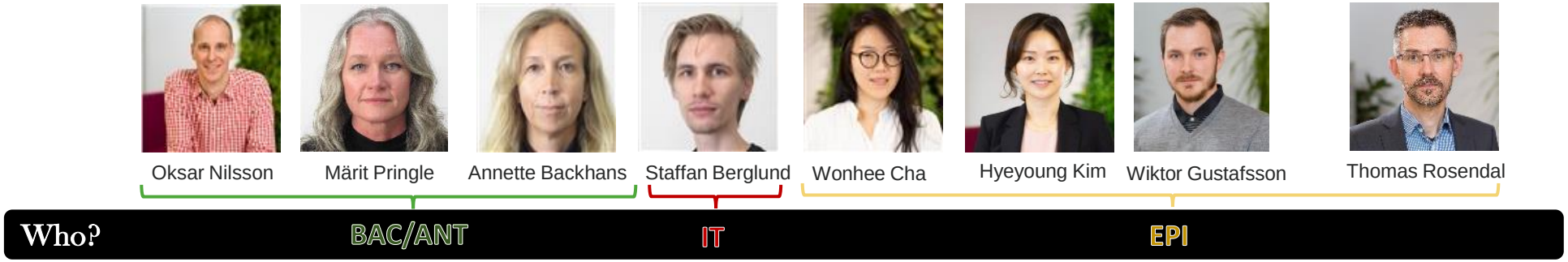
Data ready for summarization

AMR (R package)

SvarmIT

<Challenges & Lessons>

- **People with different expertise**



- **Continuous quality assurance – script (data input, data structure), pipeline breakpoints (guidelines & regulations)**
- **Good communication & collaboration with the lab**
- **Communication with stakeholders - veterinarians, Swedish board of agriculture, Public Health Agency of Sweden, other clinical labs, international parties**

Thank you for your attention!

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