Big Data analytics in the animal production domain

19th of June, 2019 – ICAR, Prague

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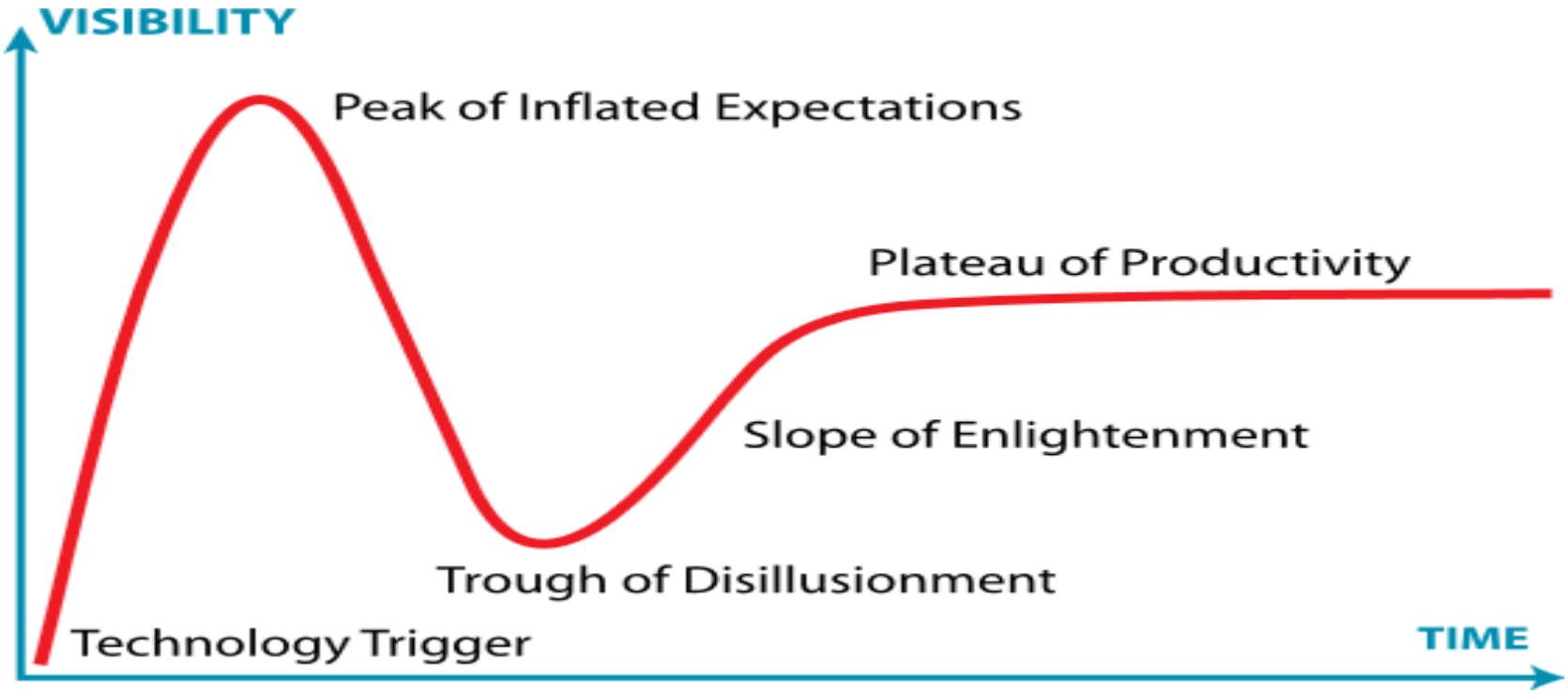
100years
1918 — 2018

Big Data

1.79 billion 317 million

monthly active users

Gartner’s hype cycle



Outline

- Big Data in Animal Agriculture?
- Example projects
- Key pointers to make Big Data useful

Big data field?

Volume

Velocity

Variety

Veracity

Variability

Value

Sources of Big Data - Machines

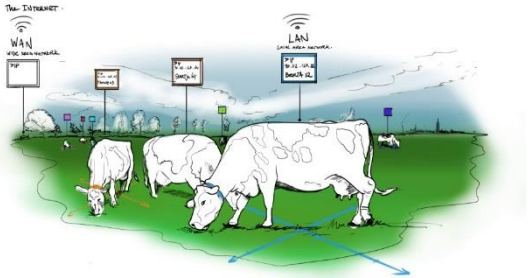
- Tractors
- Tillage equipment
- Milking robot / parlour
- Feed boxes
- .....

Sources of Big Data - Fields

- Soil analysis
- Soil type
- Soil temperature
- Ground water level
- Crop history
- .....

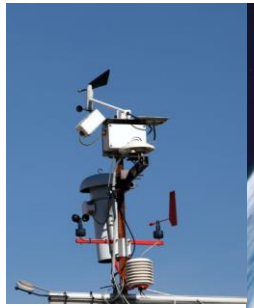
Sources of Big Data - Animals

- Genomic data
- Sensors / images
  - ID
  - Behaviour
  - Health
  - Position
  - Smart fencing
- .....



Sources of Big Data - Environment

- Gaseous emissions
  - Methane (CH_4)
  - Ammonium (NH_3)
  - Nitrous oxide (N_2O)
- Ground/surface water
- Weather
- .....



Sources of Big Data – production chain

- Slaughter data
- Tracking & tracing
- Farm management program
- Financial accounts
- .....

Outline

- Big Data in Animal Agriculture?
- Four example projects
- Key pointers to make Big Data useful

Predict lifespan of an animal still alive combining genomics and DHI

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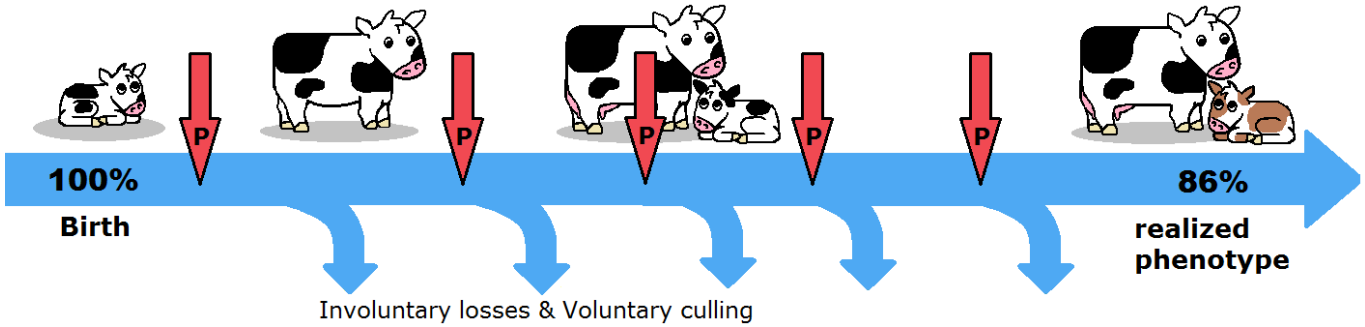
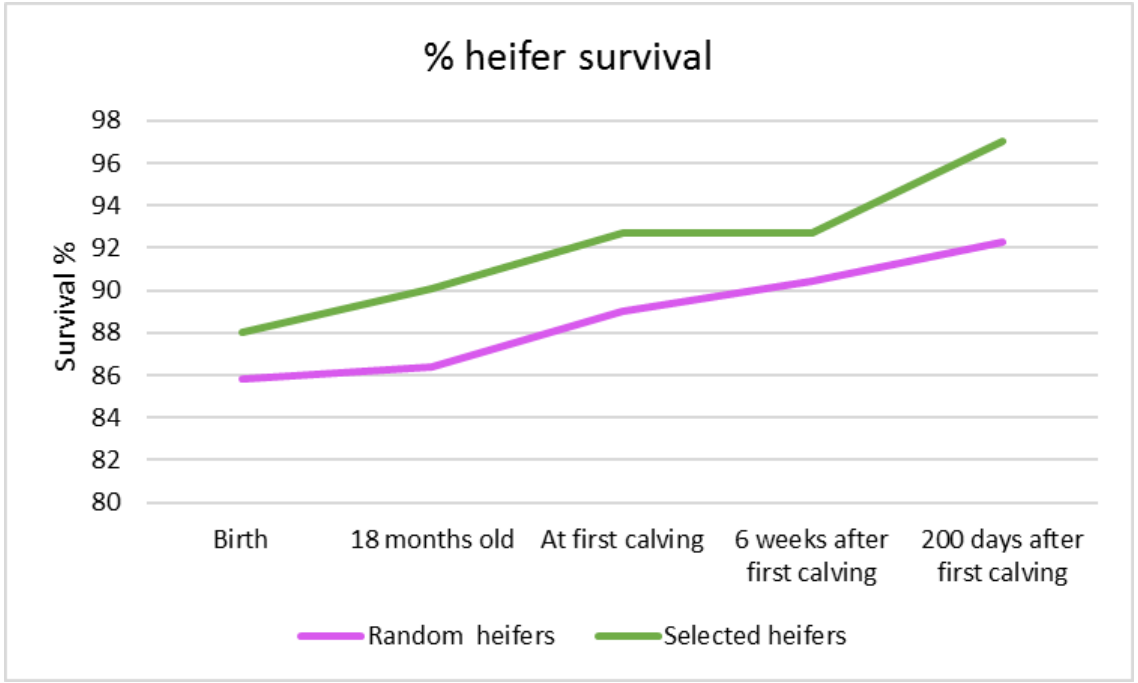
NWO Applied and Engineering Sciences

Dairy cow's longevity



- DNA: breeding value for 50 traits
- 72 additional phenotypic records; Pedigree, dam, own birth and calving records, test milk days, movement (transport), inseminations, viability & vitality of calves, survival status at various points, farm...
- Statistical methods: regression, naive bayes, random forest

Better management predicting longevity



Combination of genomic breeding values and phenotypic traits important to predict survival, even after first calving

Resilience and efficiency of animal and farms

Horizon 2020

GENTORE

BREED4FOOD

CRV

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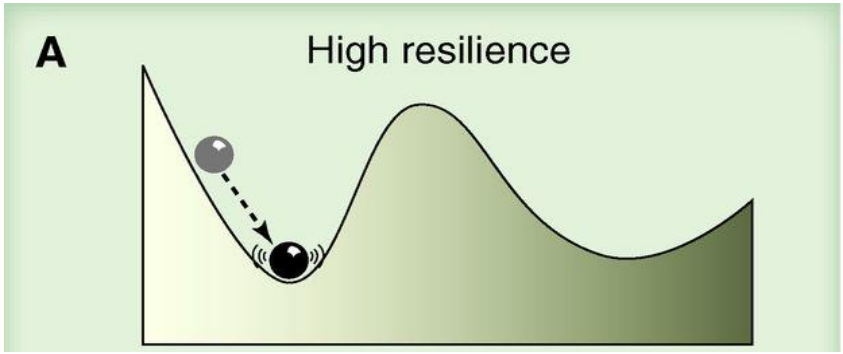
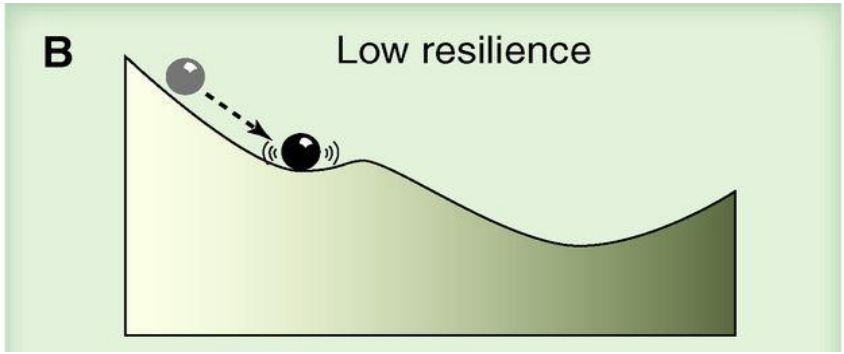
Resilience

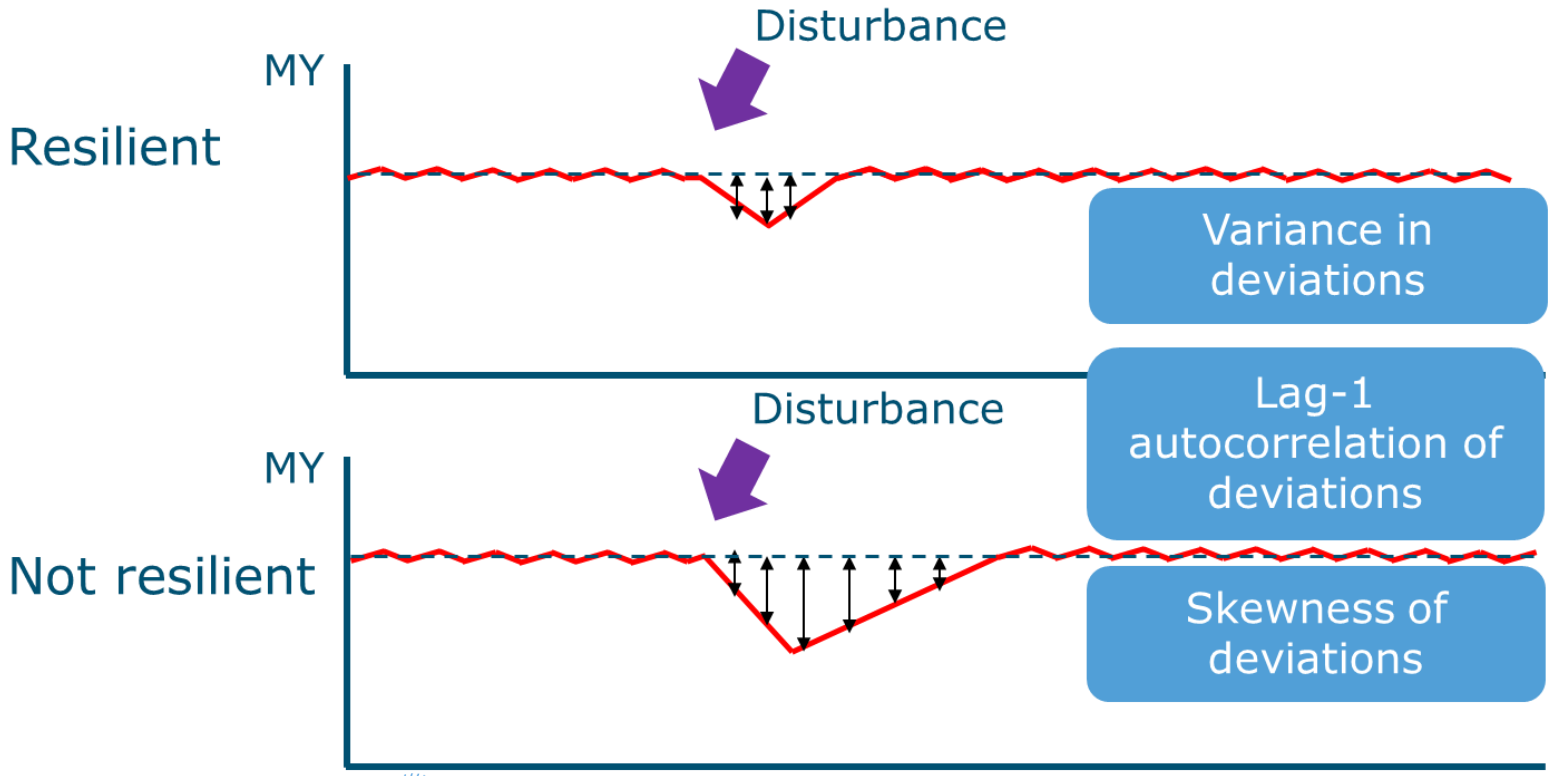
Resilience through the theory of critical transitions

Scheffer et al., 2012





Breeding for resilience using daily yield data



Environmental impact

Manure management

Erwin Mollenhorst, Claudia Kamphuis, Gerard Migchels

Environmental norms

Current situation:

- Fixed phosphate application norms for crops / grassland
- 3 classes, based on P status of field
- For crops: 50 / 60 / 75 kg P_2O_5 (app. 22 / 26 / 33 kg P)

Can we predict future maize yields (= P) based on farm data and open source weather data using artificial intelligence?

Ideas developed at Hackatons

MestHack October 2017, Dairy Campus

(Be)MestWijs won the incentive prize for most market-ready result
Job de Pater (NMI), Reinier Wieringa (EZ-Dictu), Erwin Mollenhorst (WUR), Justin Steenhuis (VAA ICT), Herbert Meuleman (CRV), Claudia Kamphuis and Gerard Migchels (both WUR). Not on foto: Roel Veerman (Akkerweb)

MaxiMy-N won with a data- en IT-implementation to measure and show ecosystem services
Mehrab Marri (MSc), Joost Lahr, Henk Janssen, Yke van Randen, Erwin Mollenhorst (all 4 WUR) and Lucas vd Zee (UvA). In front: Gerard Ros (NMI) and Charon Zondervan (jury)

BodemHack, May 2018, De Marke

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Most important combining data sources

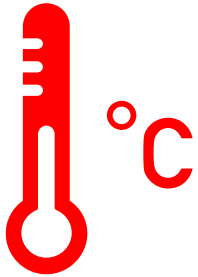
Cropping scheme

Crop in previous year (grass/maize)

Soil status

Phosphate status field

Weather



Maximum temperature in July

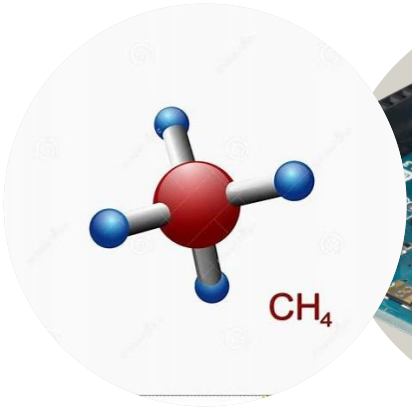
Yield history

Average Pyield maize same field past 7 yrs

A flexible data architecture to automate collection of (near) real-time methane sensor data at commercial dairy farms

Claudia Kamphuis, Yvette de Haas, Erik van den Bergh, Gerrit Seiger

Erwin Mollenhorst, Dirkjan Schokker, Roel Veerkamp



Micro.
Azure

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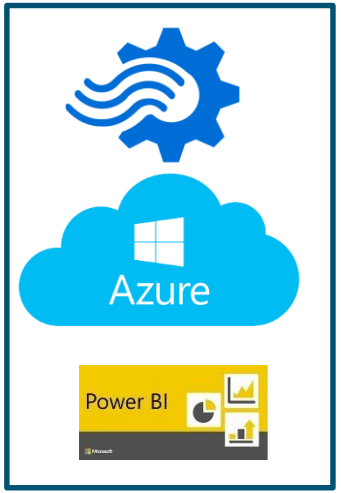
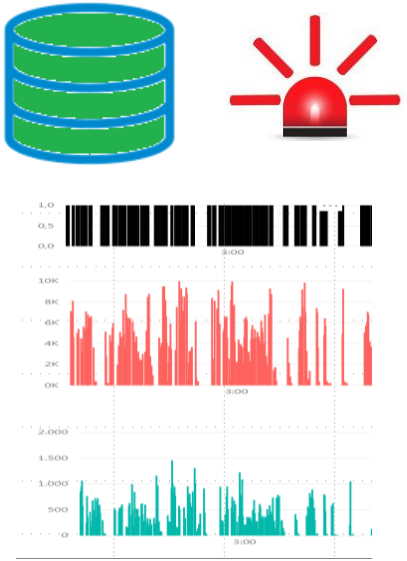
Collect and visualise methane data flexible and automated on commercial dairy farms

NB-IoT

*Data push every **3 min***



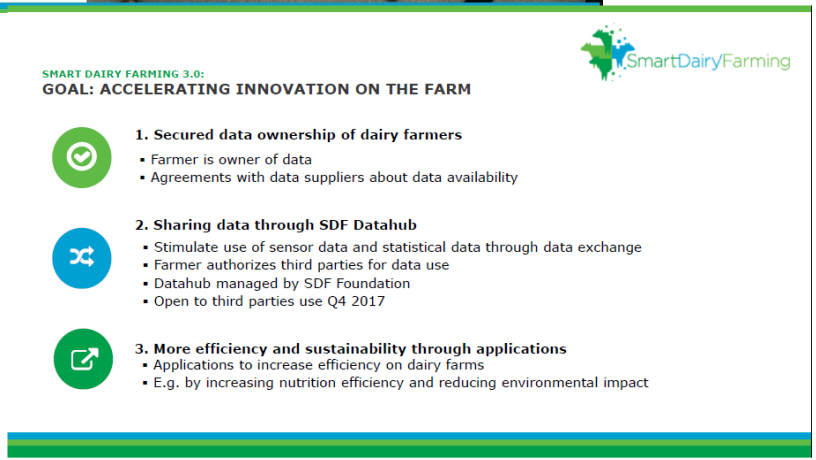


Outline

- Big Data in Animal Agriculture?
- Example projects
- Lessons learned and key pointers to make Big Data useful

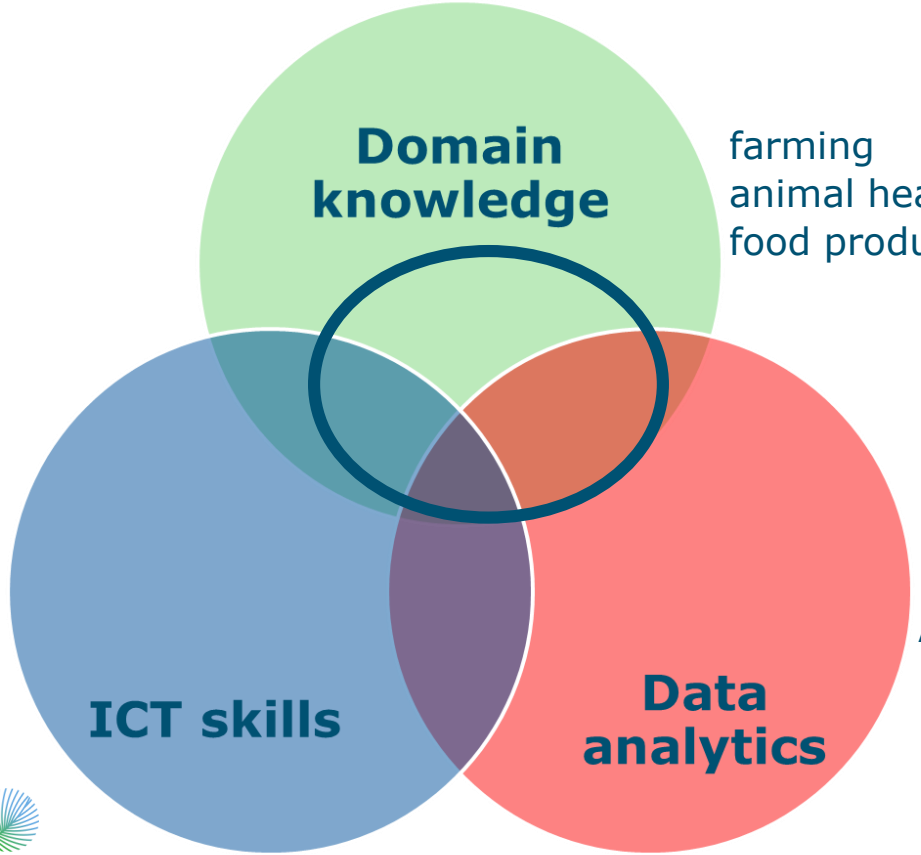
1) Organise data availability across sources

- Making data available for the benefit of ...
  - farmer
  - consultant
  - legislation
  - technology provider
  - ....



van het Land, ICAR, 2017

2) Domain knowledge is present (and leading)



farming
animal health,
food production

Cloud computing
Block chain

Artificial intelligence
Machine learning
Data lakes

3) Other people & ways of working e.g. hackatons

Computer Assisted Semen Analysis

Big data analytics & male fertility, November 2017, Dairy Campus

Multidisciplinary teams, not tech. only!
Combining data, software, hardware and design

Competition
Pressure cooker setting

Hackathon smart farming, December 2017, Westfort, Nieuwegein

Summary

- More and more big data will come available
- Key pointers to success
    - Sharing data (who organises and benefits?)
    - Domain knowledge should not be forgotten
    - Domain experts should adapt
- Data analytics is not the silver bullet!

Take home

Success in Big Data is not about technical tools, but connecting the tools with people and domain experts