Big Data in Animal Sciences

September 11th, 2018 - Rabobank Global Architecture Conference – Utrecht, the Netherlands

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100years
1918 — 2018

Sources of Big Data - Machines

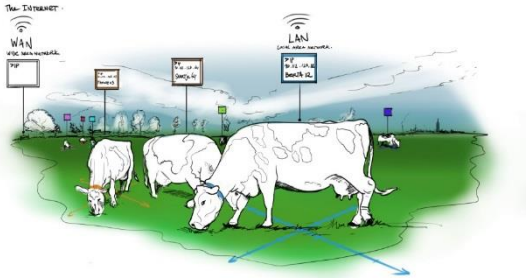
- Tractors
- Tillage equipment
- Milking robot / parlour
- Feed boxes
- .....

Sources of Big Data - Fields

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

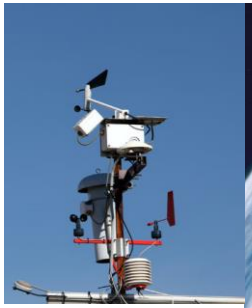
Sources of Big Data - Animals

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



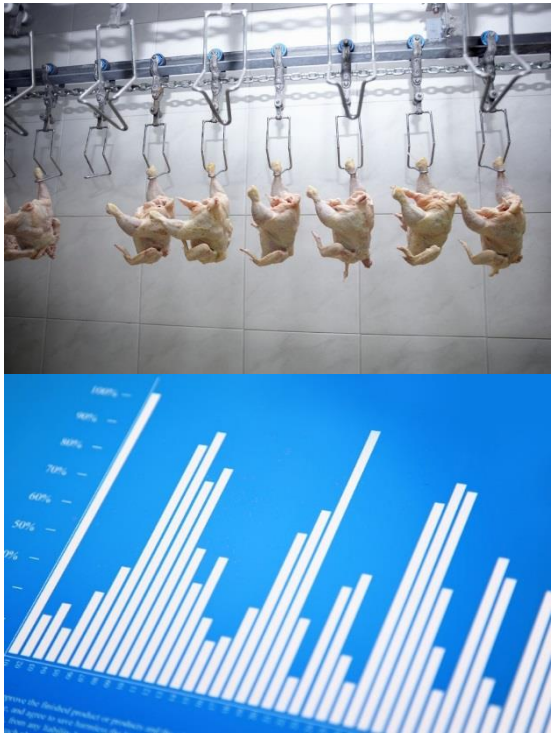
Sources of Big Data - Environment

- 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
- .....



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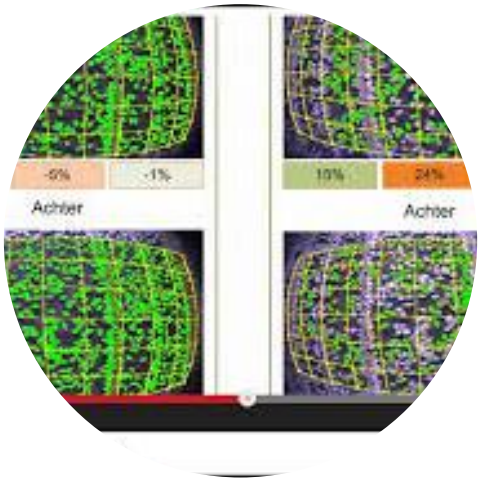
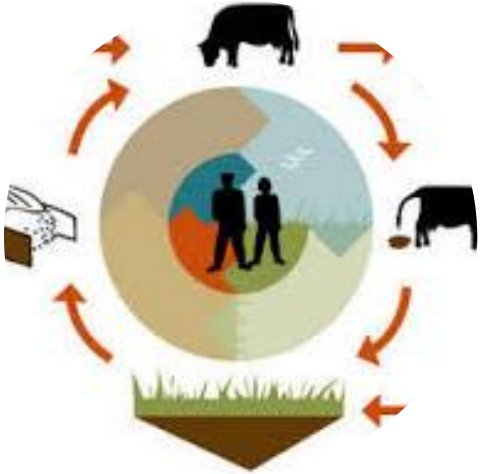
Management tools

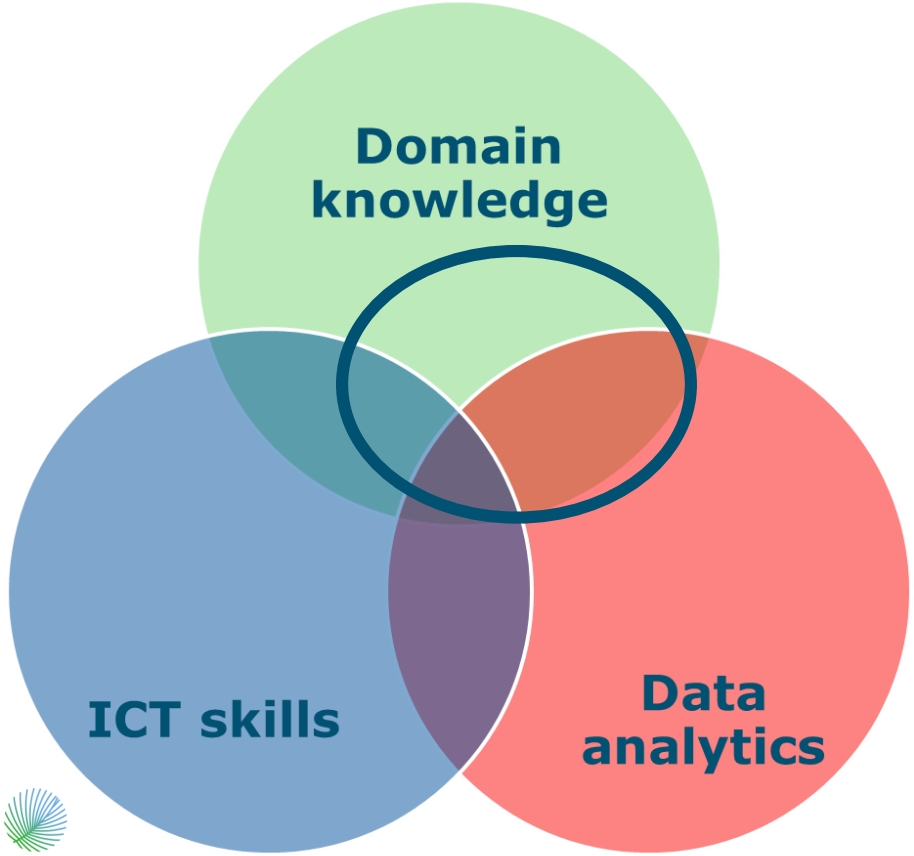


Sensor technologies



Food chain

Challenge application Big Data



Applications in Big Data projects

- Broiler chain
- Pig performance
    - Male fertility
    - Individual ID
    - Slaughterhouse data
- Dairy cow’s longevity
- Resilience and efficiency of animal and farms
- Environmental impact
    - Manure management

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Broiler chain

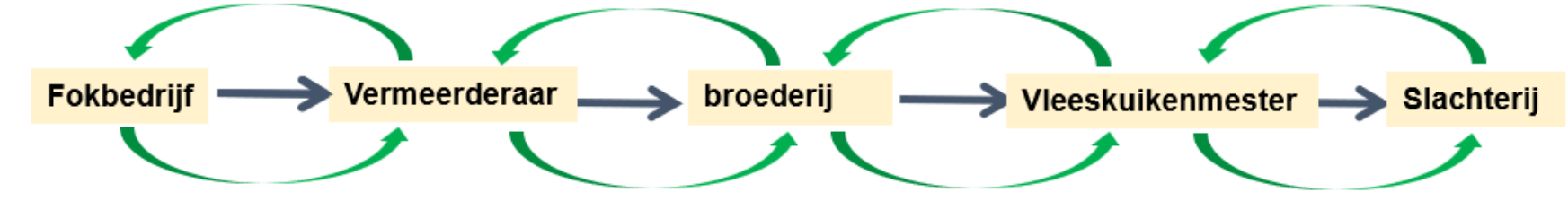
Big Data for optimizing the broiler chain

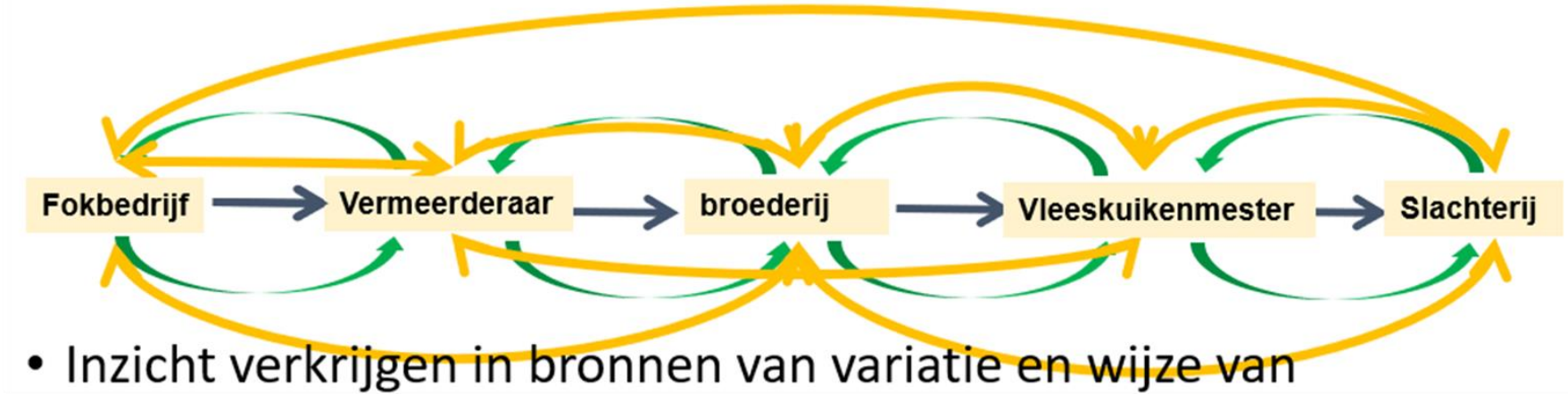
Wat is er aan de hand?

De vleeskuikenproductieketen bestaat uit individuele schakels:

Fokbedrijf → Vermeerderaar → Broederij → Vleeskuikenmester → Slachterij

Current and desired situation





- Inzicht verkrijgen in bronnen van variatie en wijze van beïnvloeden

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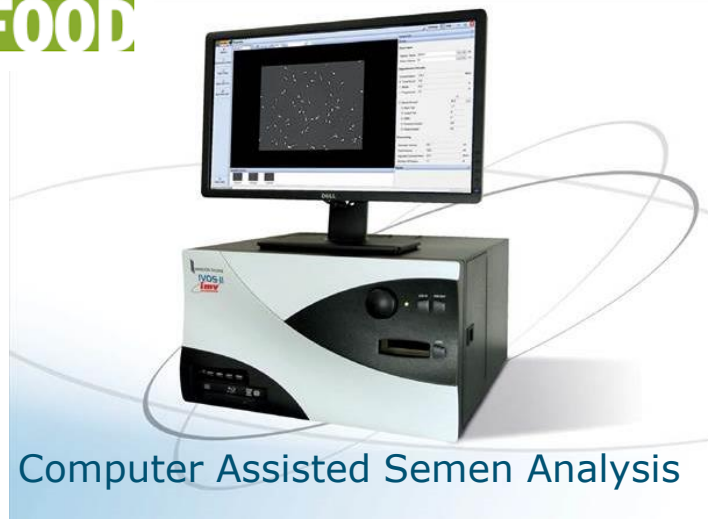
Pig performance

Pig hackatons



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

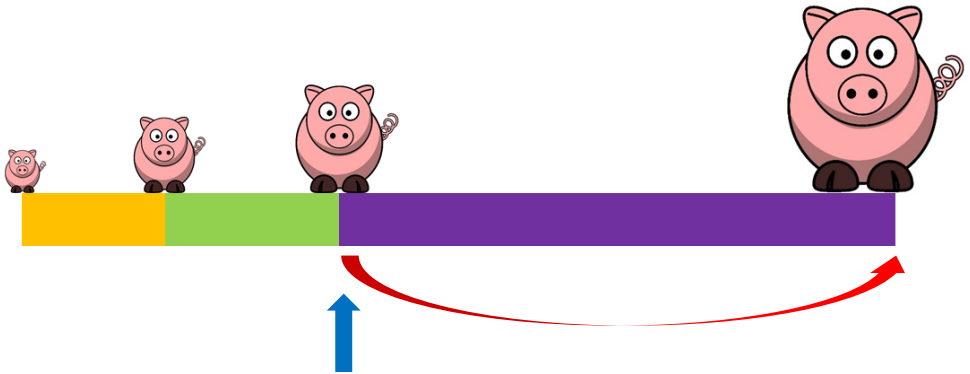
Hackathon smart farming,
December 2017, Westfort, Nieuwegein

What is a hackathon?

- Multidisciplinary teams
- Combining data, software, hardware and design
- Competition
- 24 - 36 hours
- Pressure cooker setting

Research project – pig management

To predict deviant slaughter pigs
based on routine data available at
the onset of the growing-finishing phase



Dataset from VIC Sterksel

65,208 records of individual pigs

Born between 2004 – 2016

Information on:

- Offspring, litter
- Locations, transfer dates, weights
- Slaughterhouse data

Predicted variables

Binary traits (0/1) on individual pigs

- Pneumonia (no/yes)
- 10% lowest growth rate (normal/low)
- 10% lowest meat percentage (normal/low)

Generalized boosted regression models

- gbm package in R

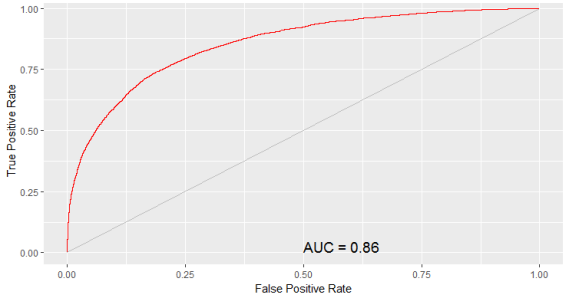
Validation

70% train, 30% test, 1 year validation

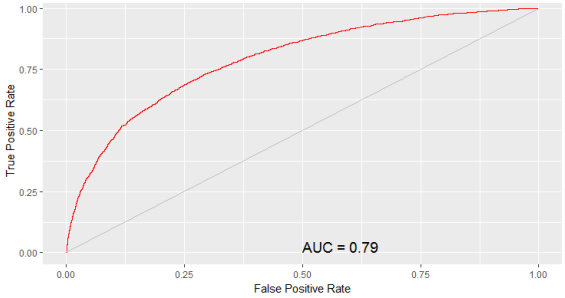
Final performance: weighted average of 4 years

Growth 2013 – AUC - sensitivity

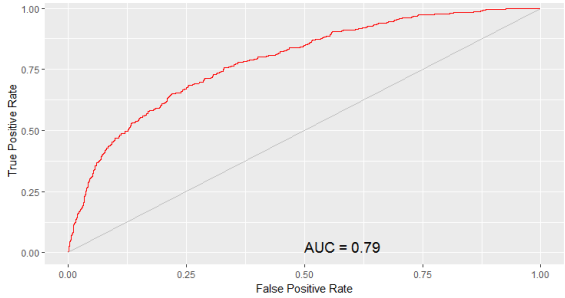
Train



Test



Validation



5 most important variables (relative influence)

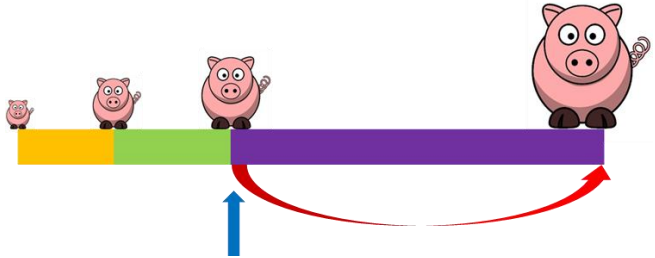
- Growing-finishing section (17%)
- Piglet section (12%)
- Weight at start growing-finishing (10%)
- Age at start growing-finishing (10%)
- Moving average slaughter weight of pen (7%)

Location

Growth

Pen/trait history

Conclusions



- No reasonable prediction for pneumonia / low meat percentage
- Better identifying pigs with low growth rate
- First step towards early warning system

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Dairy cow's longevity

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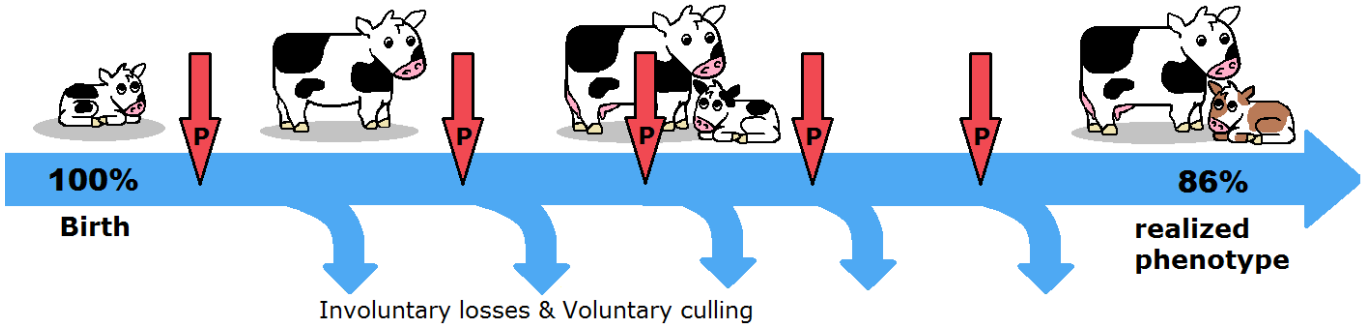
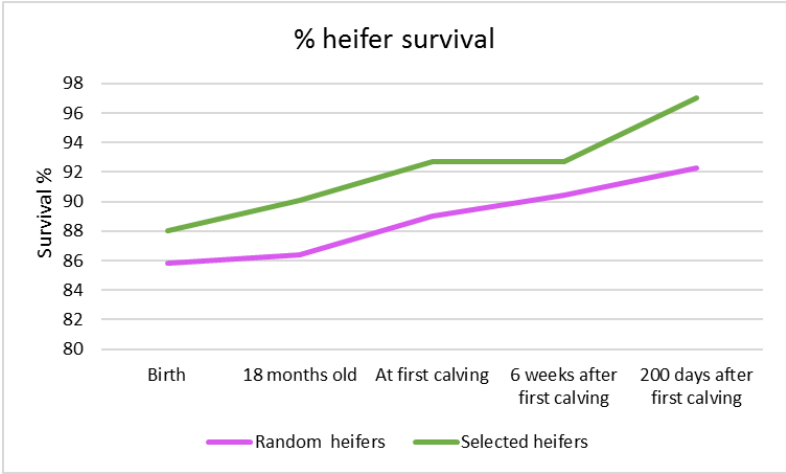
university of groningen

NWO Applied and Engineering Sciences

Dairy cow's longevity



- Important for economics, management and society
- Top 50% heifer calves are selected



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Resilience and efficiency of animal and farms

Horizon 2020

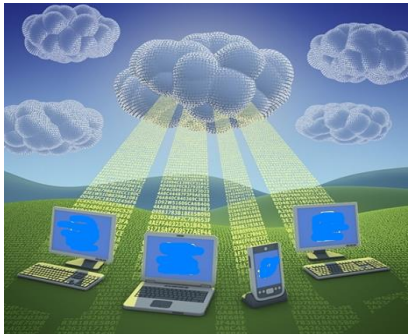
GENTORE

BREED4FOOD

CRV

WP3 On-farm phenotyping

At-market technologies



Big Data across farms

Near or far-off market technologies

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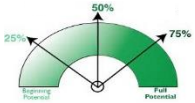
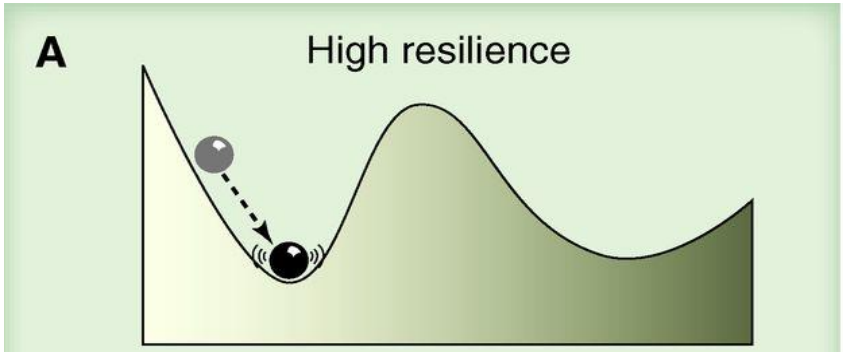
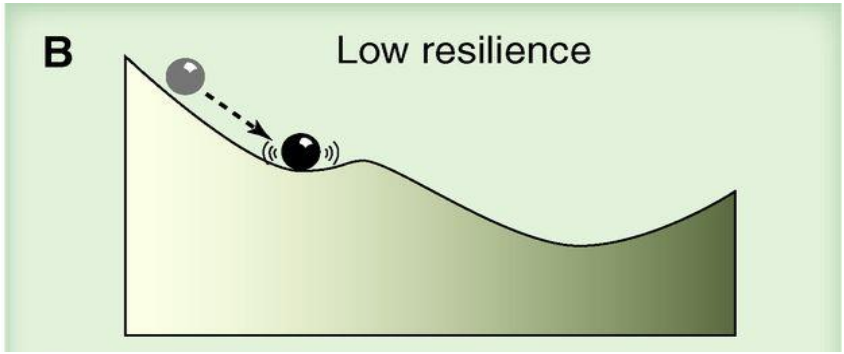
Resilience



Resilience through the theory of critical transitions

Scheffer et al., 2012





Stable state 1

Perturbation

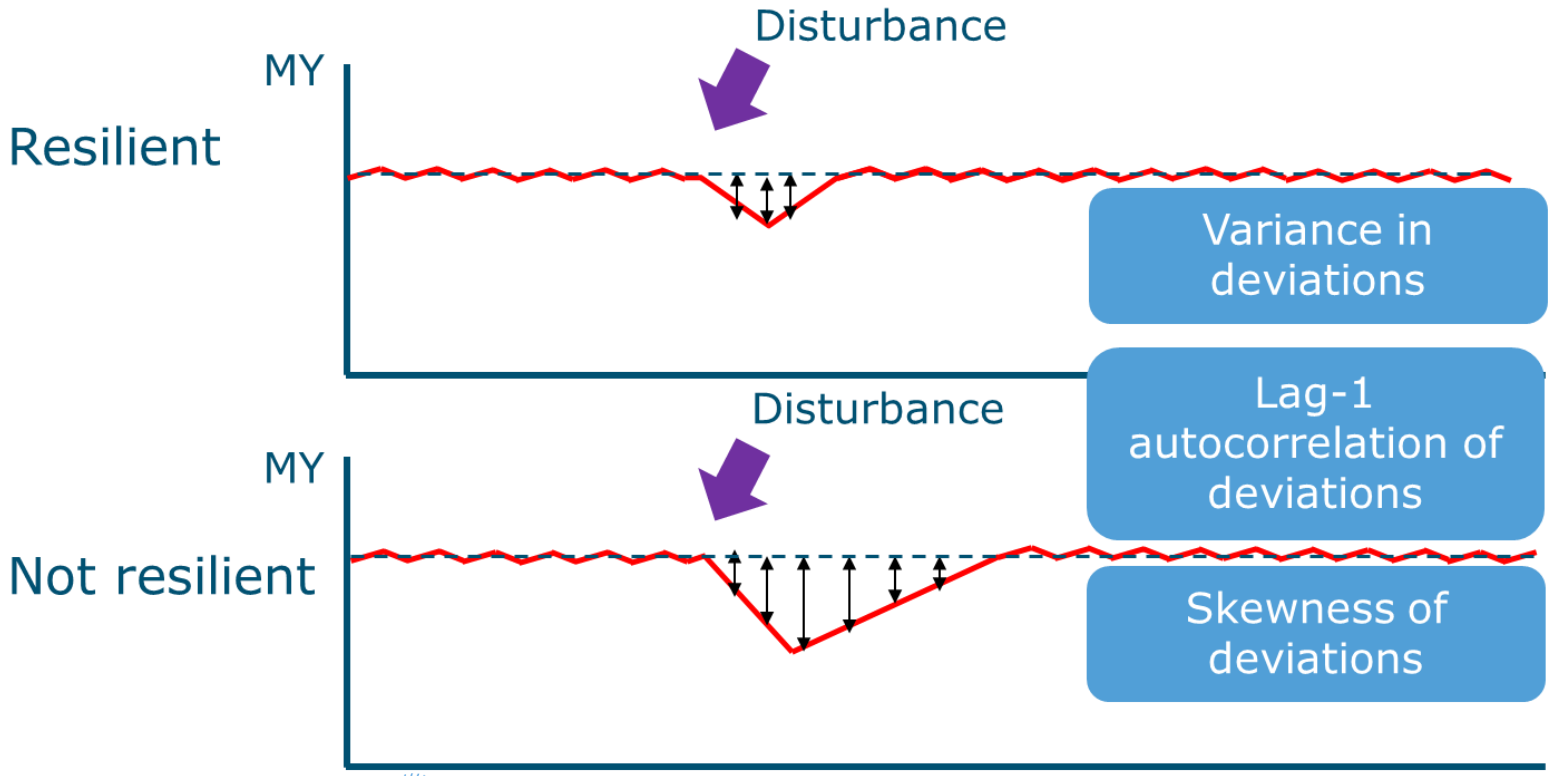
Stable state 2

Stable state 1

Perturbation

Stable state 2

Measuring resilience using existing data



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Environmental impact

Manure management

Ideas developed at Hackatons

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)

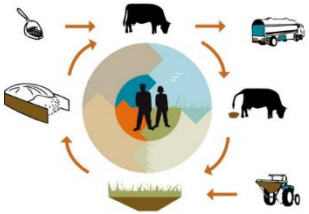
BodemHack, May 2018, De Marke

(Be)Mest wijs

step by step towards zero artificial fertilizer

Farm

Annual Nutrient Cycling Assessment (ANCA)



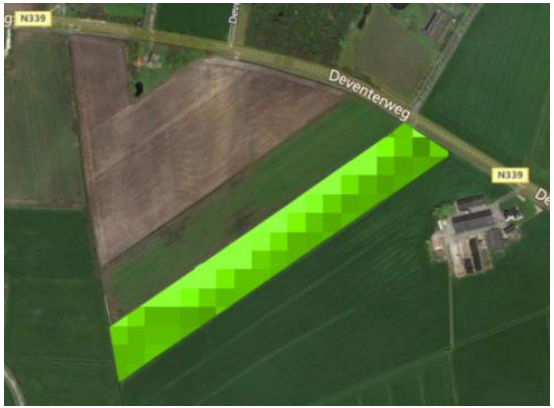
KRINGLOOP WIJZER

Field

Akkerweb

Within field

Precision fertilization



current → short term → (semi) long term

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First trials

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?

Dataset from “KTC De Marke”

162 records of maize yields

24 different fields

Years 1996 – 2014

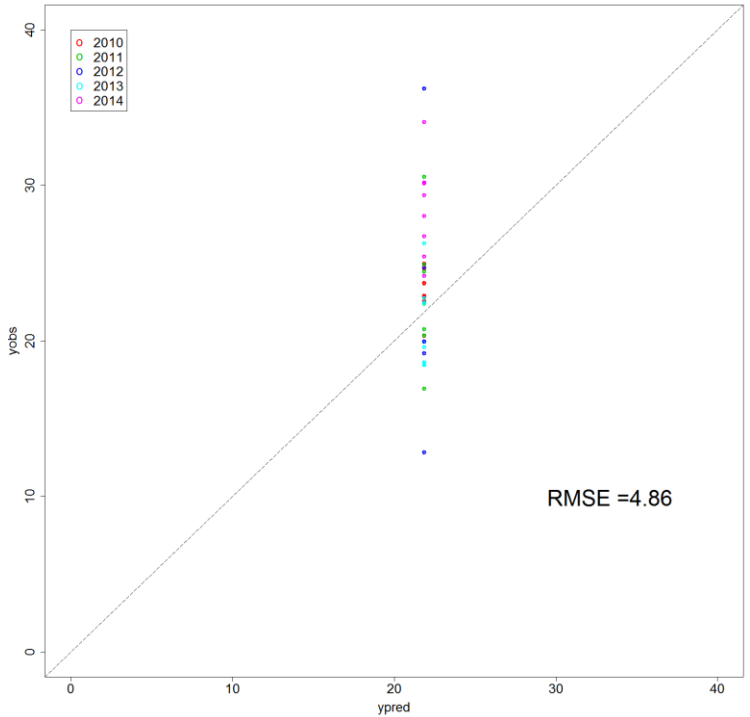
On average 7 times maize

Information on:

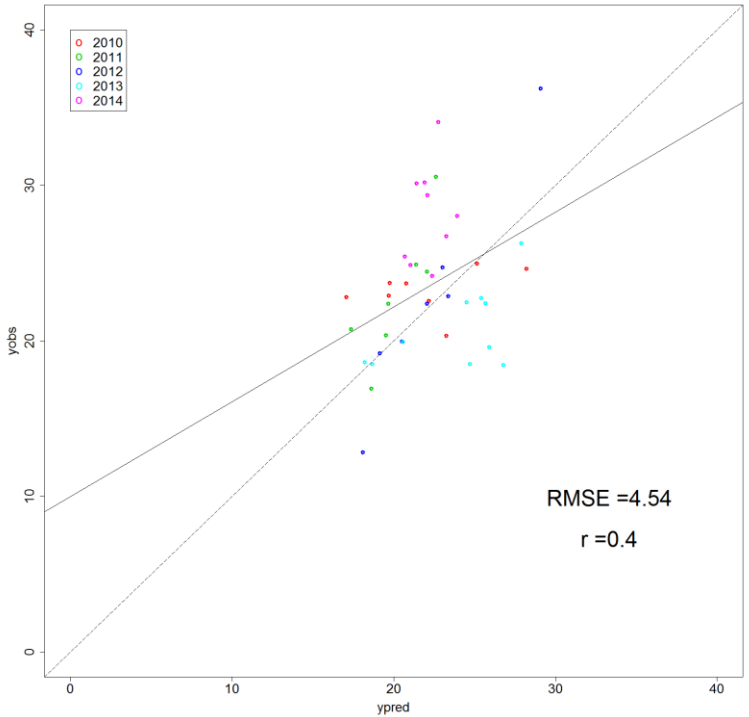
- N and P input and output
- Irrigation, P status of field
- Weather data (own weather station and open source)

Norm vs model

Norm (50 kg P_2O_5 = 22 kg P)



Predicted (validation sets)



Most important variables

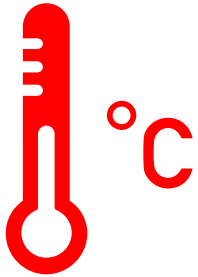
Cropping scheme

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

Summary

- More and more big data will come available (4xVs)
- Technology will allow us to use it in management, better use sensors and connection in food production chain
- Technology is not the silver bullet!

Thanks for your attention

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

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