

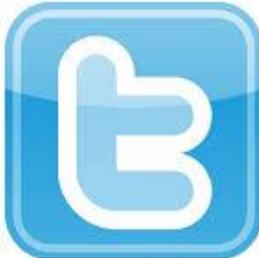
# Big Data in Animal Agriculture

December 5<sup>th</sup>, 2018 – ICBF ICBF & Sheep Ireland Genetics Conference – Athlone, Ireland

Roel Veerkamp, Wageningen Livestock Research



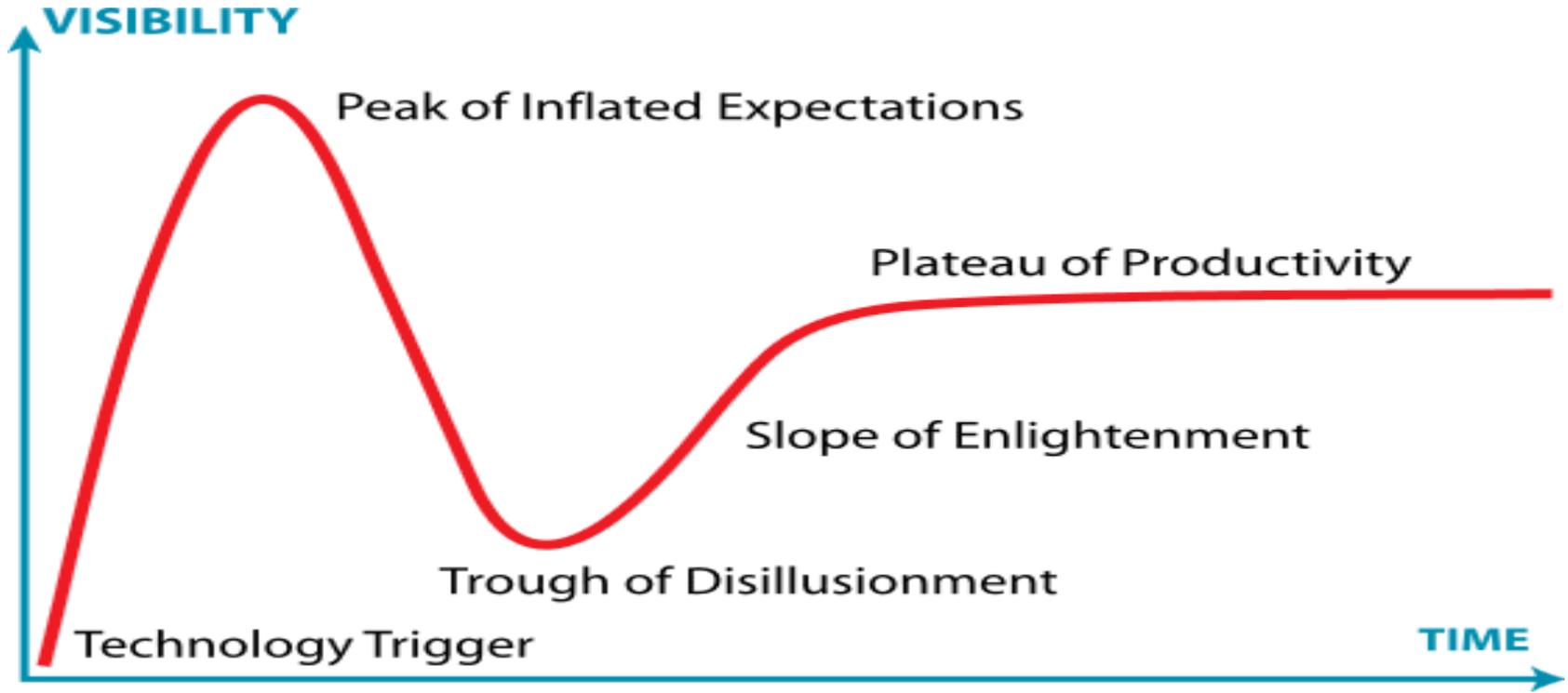
# Big Data



1.79 billion    317 million  
monthly active users



# Hype cycle



# Outline

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

# What is big data field?

Volume

Velocity

➤ Capability to acquire, and interpret data **real-time**

Variety

➤ Forms of data (text, tweets, video, drone images)

Veracity

➤ Reliability and quality of data

Variability

➤ Data whose meaning is constantly changing

Value

➤ Expectations are huge **if** analysis of Big Data delivers insights and information

# Outline

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

# Sources of Big Data - Machines

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



# Sources of Big Data - Fields

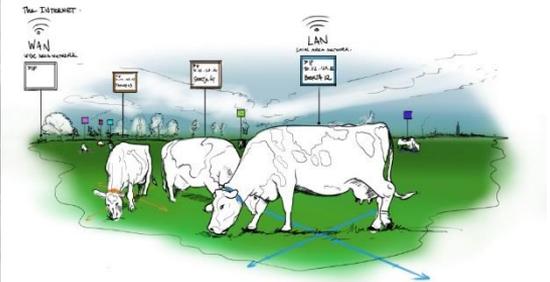
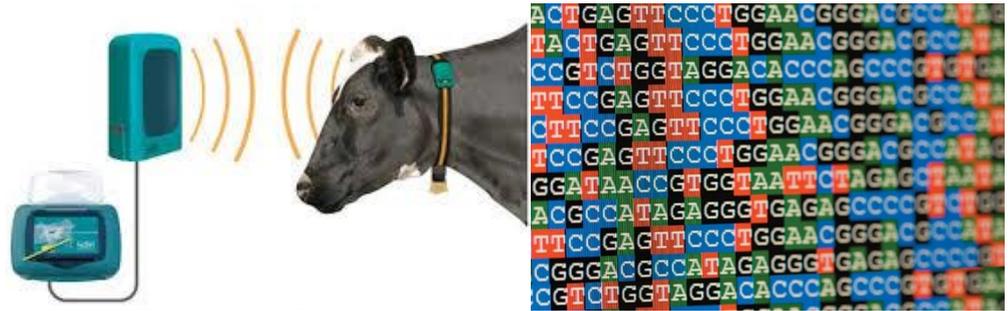
- Soil analysis
- Soil type
- Soil temperature
- Ground water level
- Crop history
- .....



# Sources of Big Data - Animals

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

■ .....



# Sources of Big Data - Environment

- Gaseous emissions
  - Methane ( $\text{CH}_4$ )
  - Ammonium ( $\text{NH}_3$ )
  - Nitrous oxide ( $\text{N}_2\text{O}$ )
- Ground/surface water
- Weather
- .....



# Sources of Big Data – production chain

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



# Outline

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

# Key pointers to make Big Data useful (1)

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

....



SMART DAIRY FARMING 3.0:

GOAL: ACCELERATING INNOVATION ON THE FARM



### 1. Secured data ownership of dairy farmers

- Farmer is owner of data
- Agreements with data suppliers about data availability



### 2. Sharing data through SDF Datahub

- Stimulate use of sensor data and statistical data through data exchange
- Farmer authorizes third parties for data use
- Datahub managed by SDF Foundation
- Open to third parties use Q4 2017



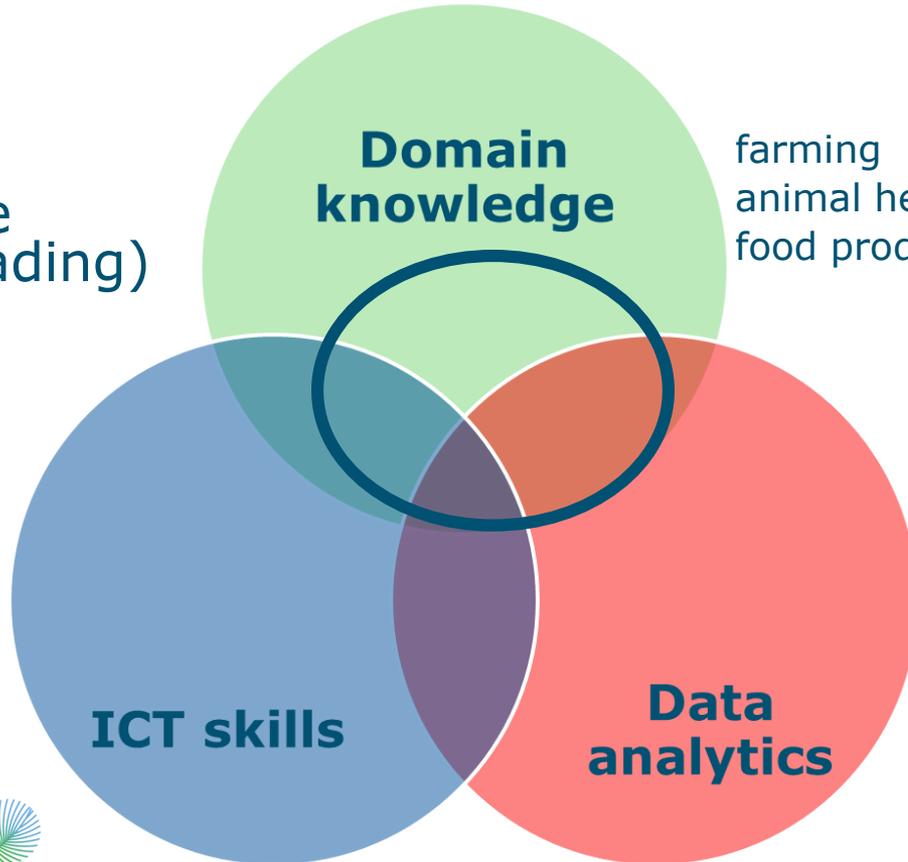
### 3. More efficiency and sustainability through applications

- Applications to increase efficiency on dairy farms
- E.g. by increasing nutrition efficiency and reducing environmental impact

# Key pointers to make Big Data useful (2)

Make sure domain knowledge is present (and leading)

Cloud computing  
Block chain



farming  
animal health,  
food production

Machine learning  
Data lakes

# Key pointers to make Big Data useful (3)

## Other ways of working e.g. hackatons

Multidisciplinary teams

Combining data, software, hardware and design

Competition

24 - 36 hours

Pressure cooker setting



Computer Assisted Semen Analysis

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



**Hackathon smart farming,  
December 2017, Westfort, Nieuwegein**

# Outline

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

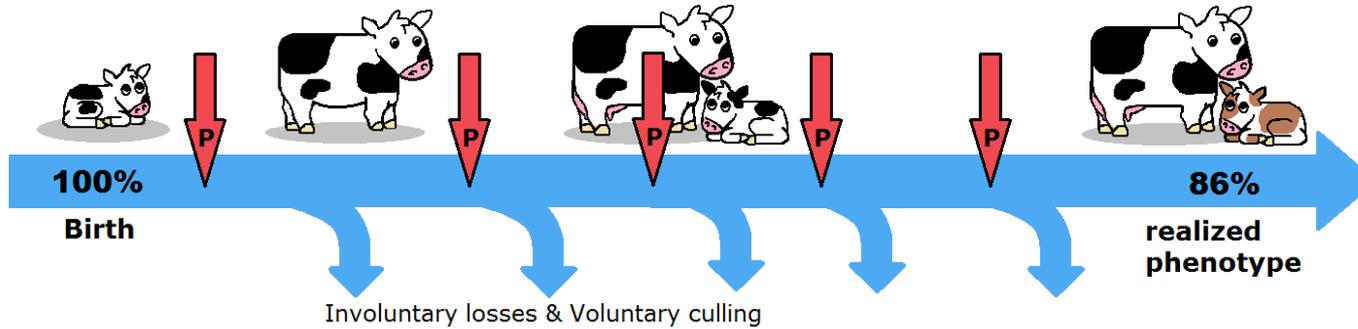


# Big Data & Wageningen Livestock Research

Predict which animal  
is going to have best herdlife

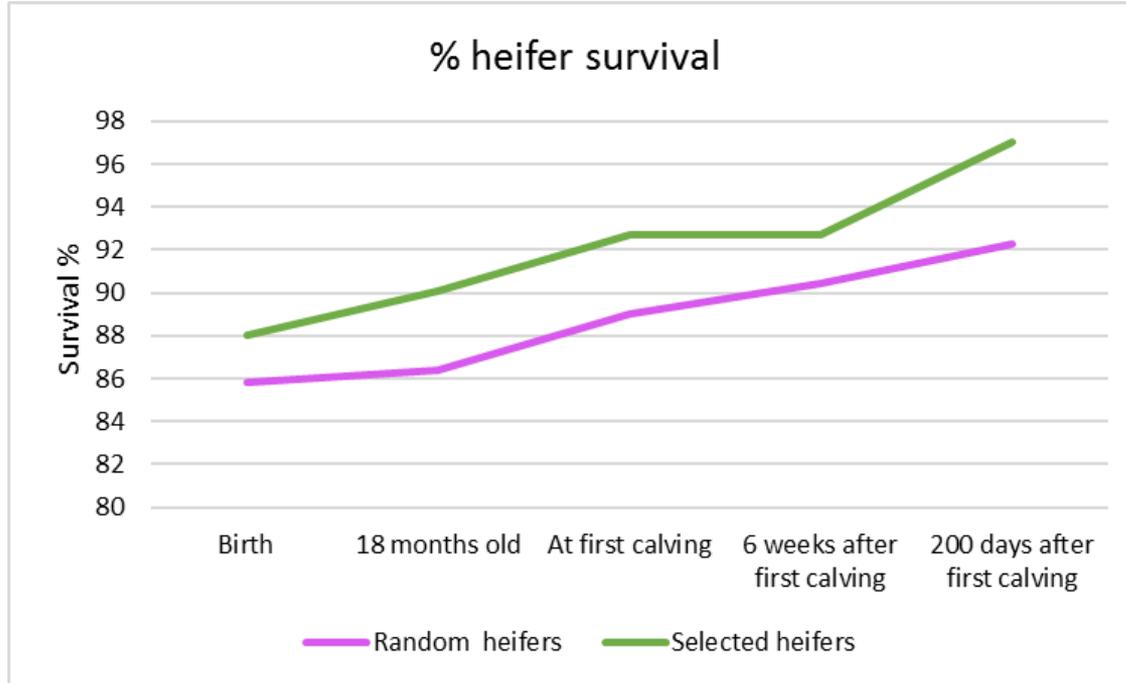


# Dairy cow's longevity



- 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: Machine learning

# Better management predicting longevity



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

# Big Data & Wageningen Livestock Research

## Resilience and efficiency of animal and farms



Horizon 2020

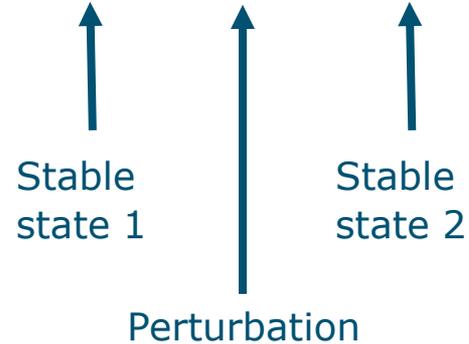
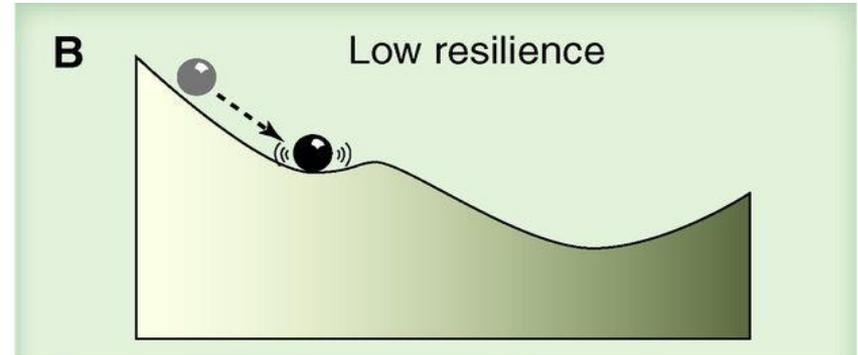
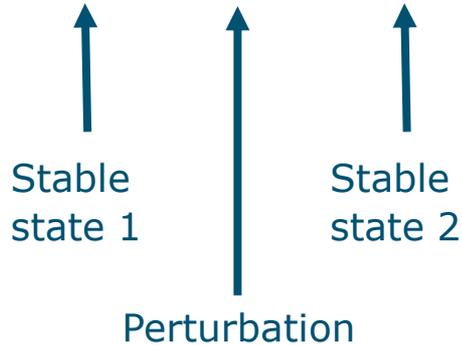
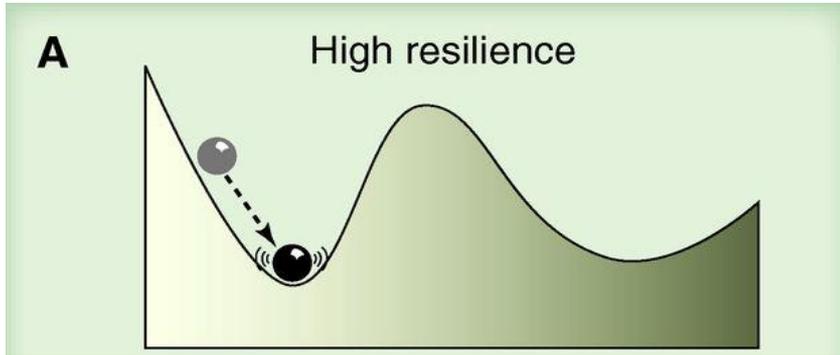


# Resilience

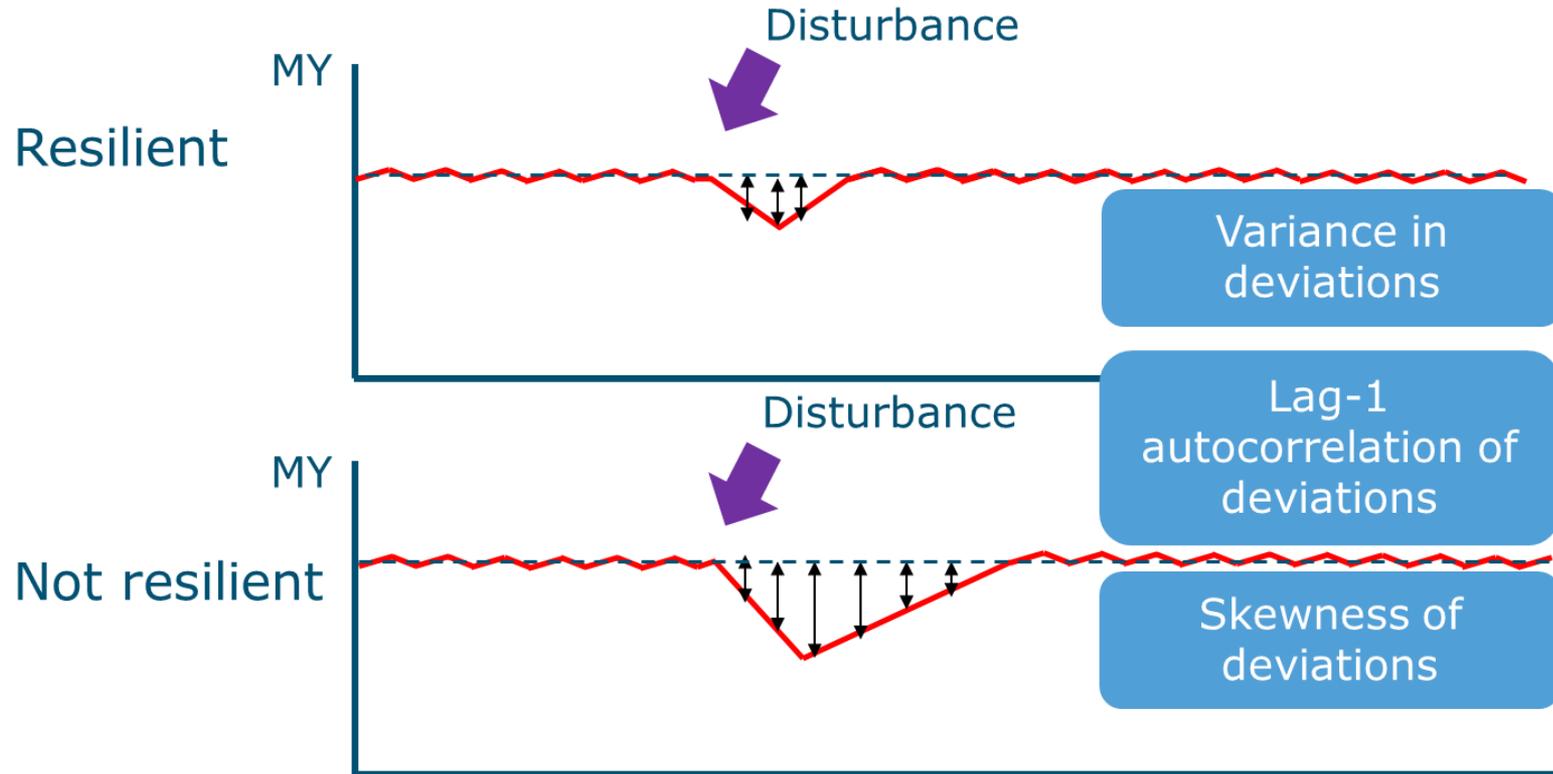


## Resilience through the theory of critical transitions

Scheffer et al., 2012



# New breeding trait resilience using existing data



# Big Data & Wageningen Livestock Research

## 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?

# Ideas developed at Hackatons



## MestHack October 2017, Dairy Campus



**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

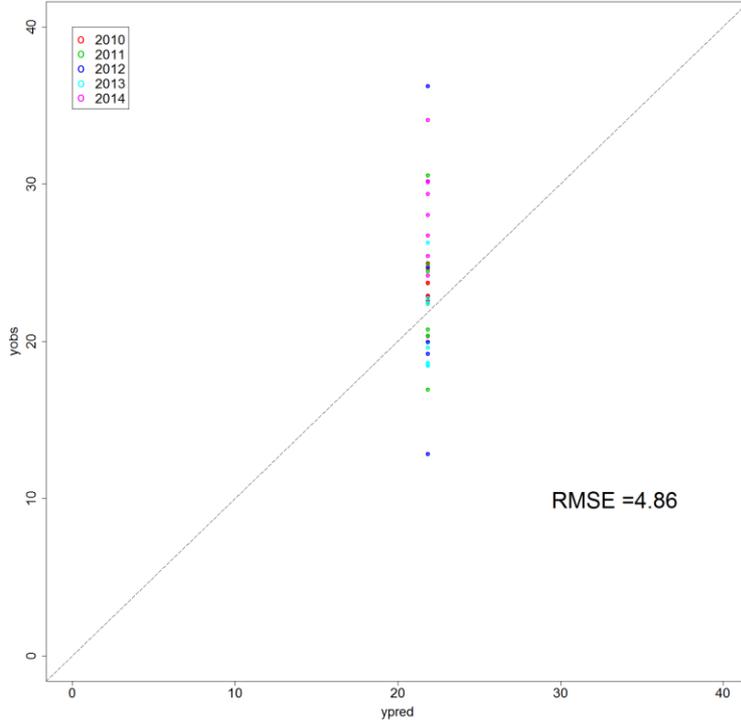
**(Be)MestWijs** won the incentive prize for most market-ready result

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)

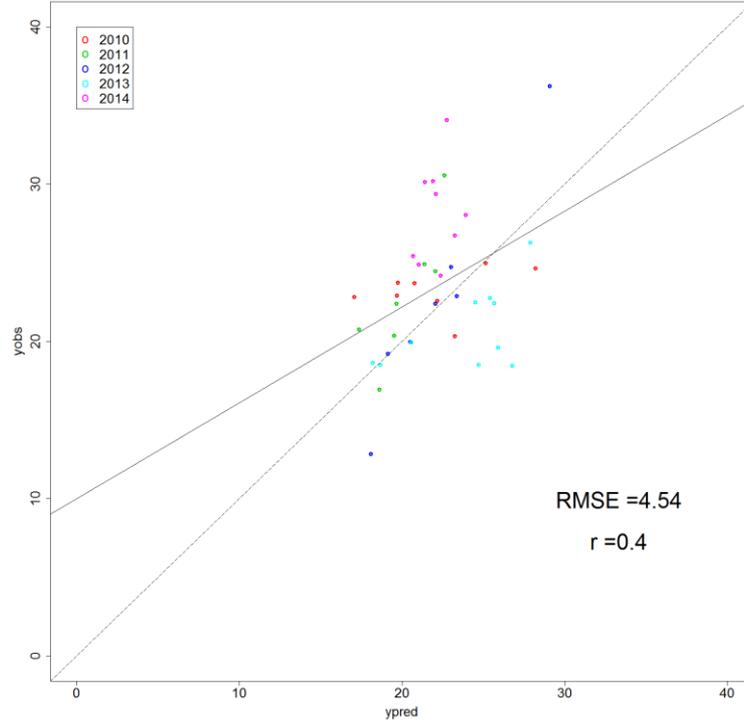


# Norm vs model

Norm (50 kg P<sub>2</sub>O<sub>5</sub> = 22 kg P)



Predicted (validation sets)



# Most important variables

## Cropping scheme



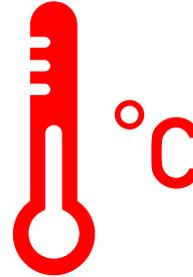
Crop in previous year  
(grass/maize)

## 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
- Key pointers to success
  - Sharing data (who organises and benefits?)
  - Domain knowledge should not be forgotten
  - Domain experts should adapt
- 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

[Roel.Veerkamp@wur.nl](mailto:Roel.Veerkamp@wur.nl)

