'Could PRRS outbreaks be early detected or even predicted through Big Data?'
'Could PRRS outbreaks be early detected or even predicted through Big Data?'

Digital transformation
(and the internet of the swine things)

Carlos Piñeiro

DVM, MSci, Diplomate ECPHM,
Candidate PhD

pigChamp pro europa

Danish Swine Congress,
Billund
2 Nov 2017

Content

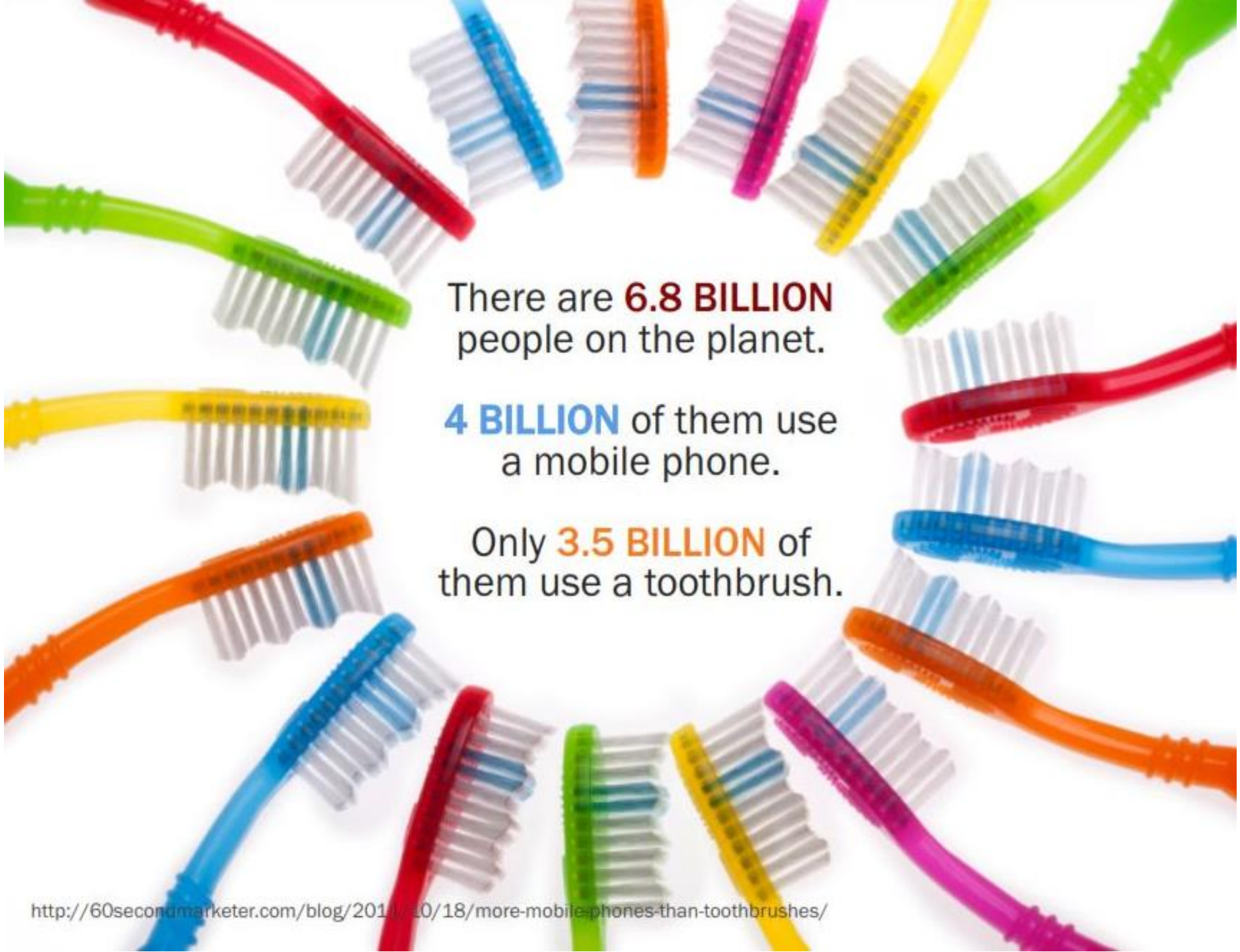
What drives the world today?

IoT and Big Data

Hidden knowledge in Big Pig Data

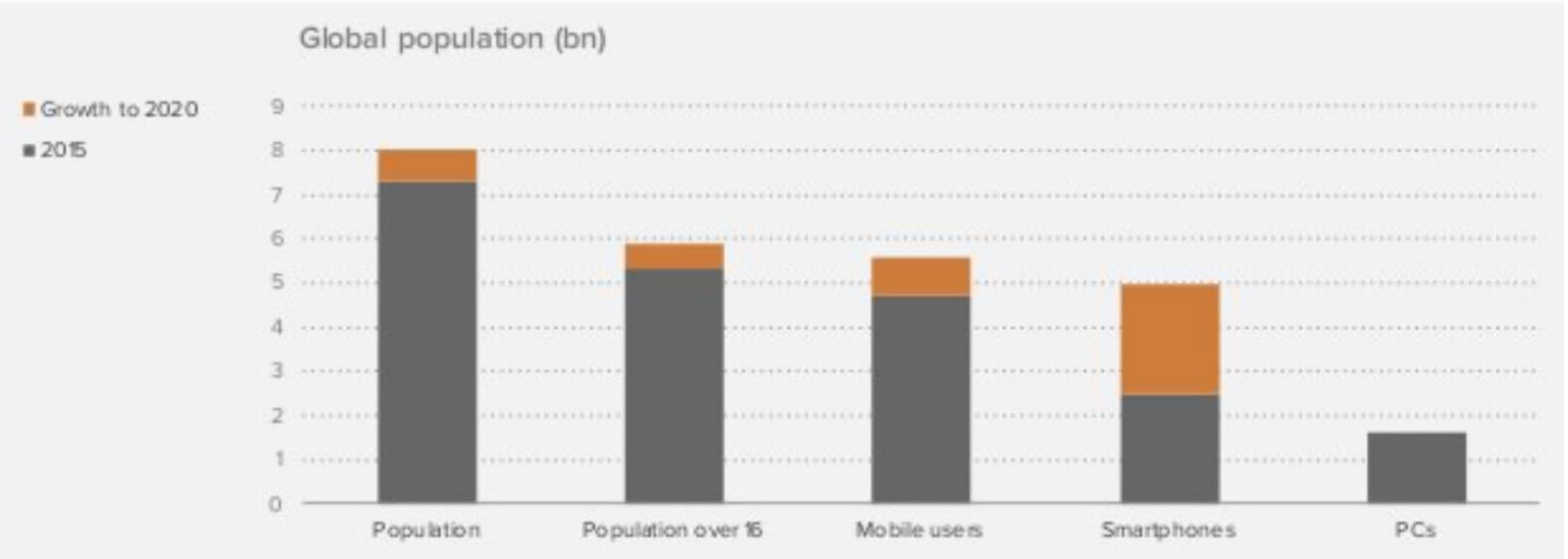
Can we predict diseases through data?

Afterthoughts


There are 6.8 BILLION
people on the planet.
4 BILLION of them use
a mobile phone.
Only 3.5 BILLION of
them use a toothbrush.
http://60secondmarketer.com/blog/2011/10/18/more-mobile-phones-than-toothbrushes/

The world in 2020

By 2020 perhaps 5bn people on earth will have a smartphone



An iPhone 6 CPU has 625 more chips than a 1995 Pentium

iPhone 6 launch weekend Apple sold 25 x more CPU chips than were in all the PC's on earth in 1995

Everyone gets a pocket supercomputer

Everyone gets a pocket supercomputer

Mobile takes computing to people hardly touched by technology before

The first universal tech product

Mobile completes a journey from one computer on earth to a computer in every pocket

EXIT
91 % of the adults have their
phones within arm's reach **24 / 7**

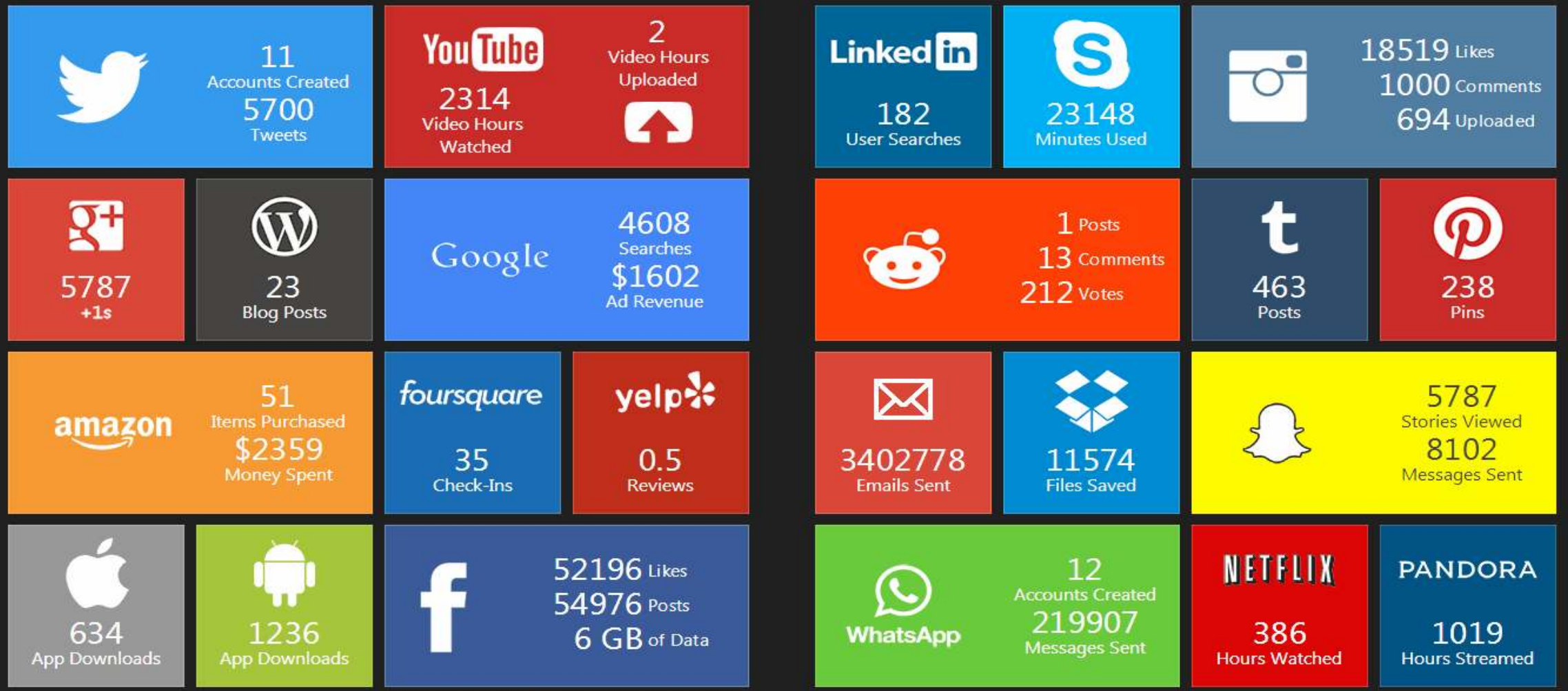
NOMOPHOBIA

FB RC E

OR LOSING YOUR

The Internet in Real-Time

How Quickly Data is Generated



By the way, in the 1 seconds you've been on this page, approximately 22574 GB of data was transferred over the internet.

Internet of the Things (IoT)

- It is a term tha represents a collection of ideas, devices and processes.
- Each thing is represented by a device or a sensor.
- These things are usually working together to create larger solutions by sending and reacting to data from an eco-system.

PIG
DATA
%
00101100101110101010100000111010

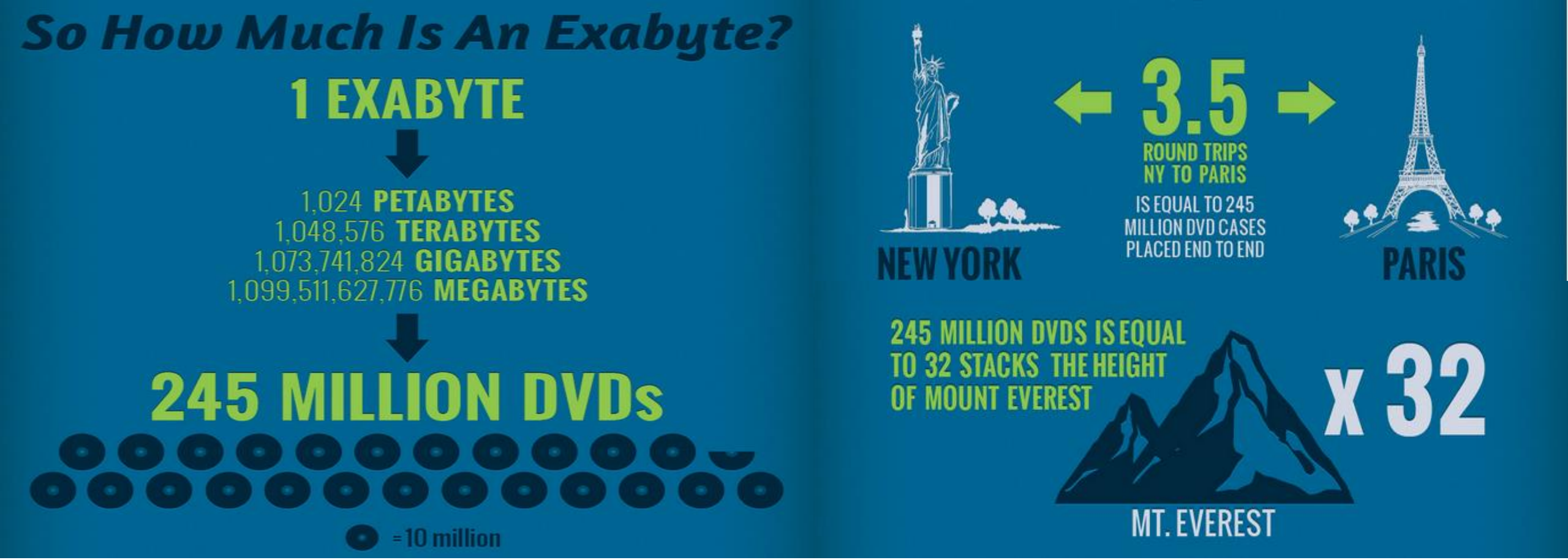
BIG DATA

The real issue is making sense of big data and finding patterns in it that help organizations make better business decisions.

Gartner

2.5 billion gigabytes (2.5 exabytes) of data are created every day. That number doubles every month.

IBM



Recent: 340 newspapers to every person on earth everyday

Most of Big Data is NOISE
Must be cleaned up

Data from different sources

Production Management Software (any)

.txt, .csv files

VBA

SQL Server

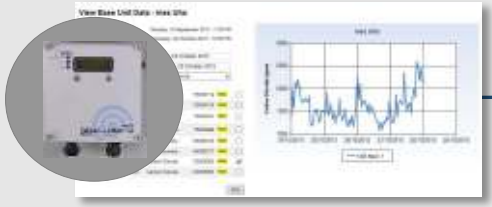
Digital Pen

.xml, .csv files

VBA

Parser: java

Environmental Sensors



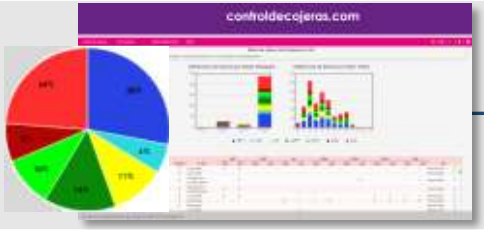
Web Service

ESF (feed intake, weight…)

.csv files

Integrate with Pigchamp

Web applications



PHP
XHTML
CSS
JavaScript…

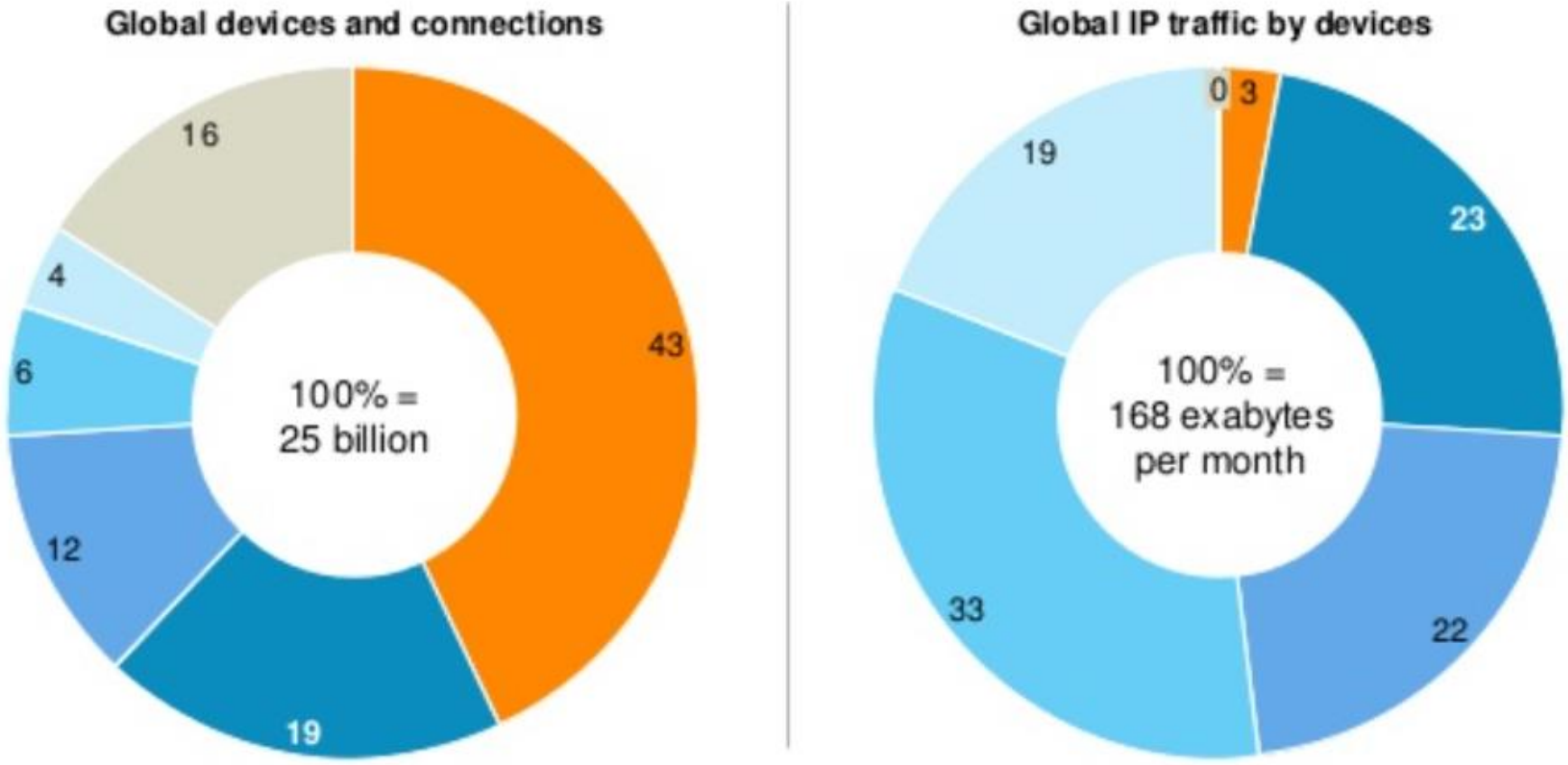
Database MySQL /SQL

Analysis and data visualization

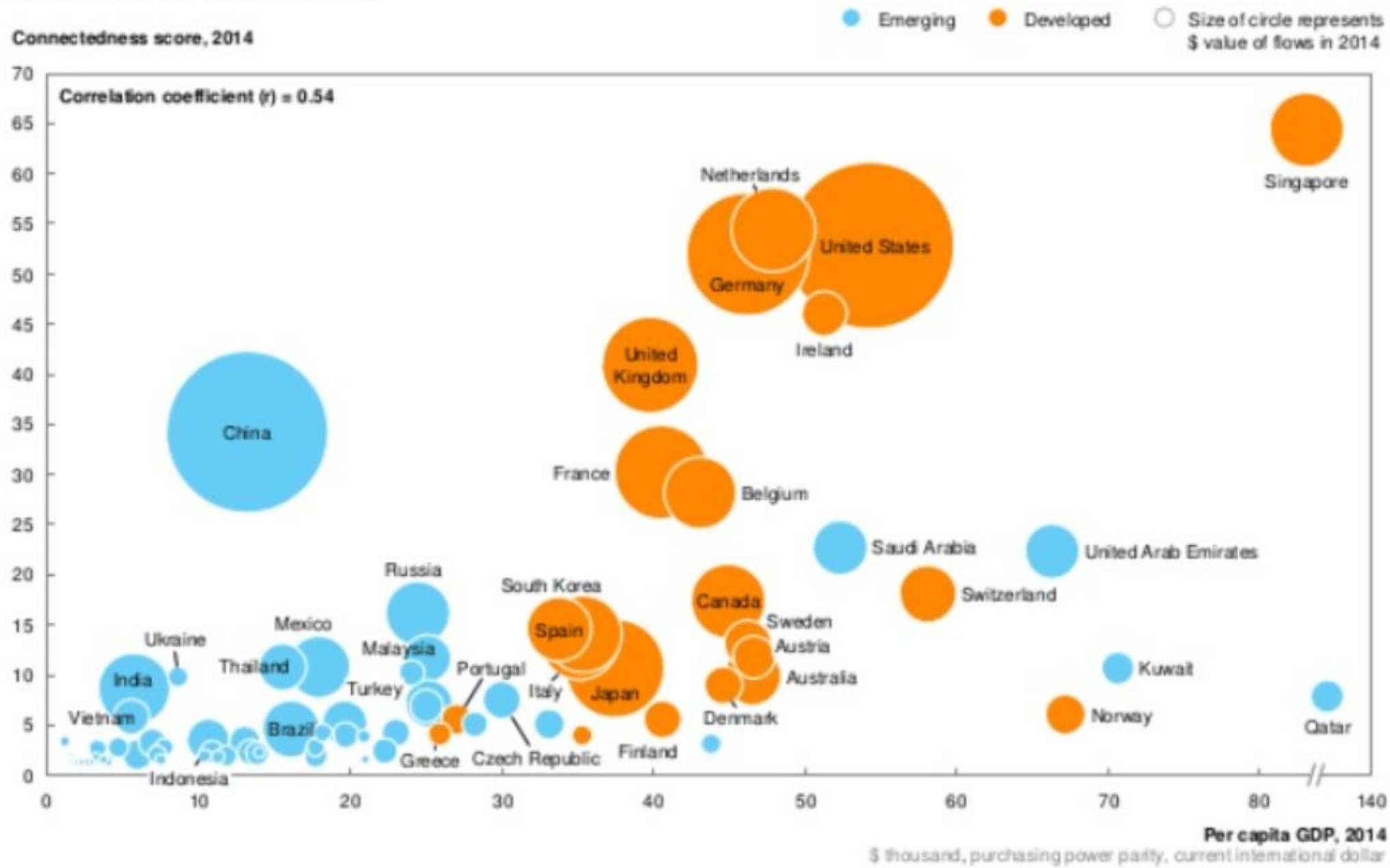
By 2019, machine-to-machine connections are expected to account for more than 40 percent of global devices and connections

Connections, 2019

Machine-to-machine (M2M) | Smartphones | TVs | PCs | Tablets | Other



A small group of leading countries are much more connected than the rest of the world



Global forum for innovations in agriculture

HOME ABOUT EXHIBITION CONFERENCE / WORKSHOPS REGISTER TO ATTEND MEDIA

20-21 JUNE 2018 THE NETHERLANDS
Jaabeurs Expo Center, Utrecht

DAYS 279 HRS 10

Co-located with vlv

In co-operation with Proagrica

SELL YOUR SOLUTIONS AT THE WORLD'S LARGEST DEDICATED EXPO OF SUSTAINABLE AGRICULTURE INNOVATIONS

75% of visitors attend GFIA to find new sustainable agriculture innovations. They want to save natural resources, improve productivity, increase the efficiency of their supply chains and be ready to meet the challenges of climate change.

If you can help food producers and processors do that, you can sell your solutions at GFIA Europe.

Welcome
H.E. Martijn van Dam
Minister for Agriculture of the Netherlands
Global forum for innovations in agriculture
2017 | UTRECHT | THE NETHERLANDS
9-10 May: Jaarbeurs Expo Centre
Proagrica
IBMA
planet.
GODAN
tff
syngenta
SAI

Golden triangle for innovation

Private sector

Public Administration

Universities, Research Centers

Innovation pillars in Agribusiness

Smart Technologies

Drones, robotics, sensor and Big Data

- Precision feeding and fertilization
- Early disease detection
- More efficient processing

Genomics

What genes do what

-Faster selection of new improved generations.

-Customized management of new breeds.

- Customized feeding of new breeds and customers

Bio-refinery

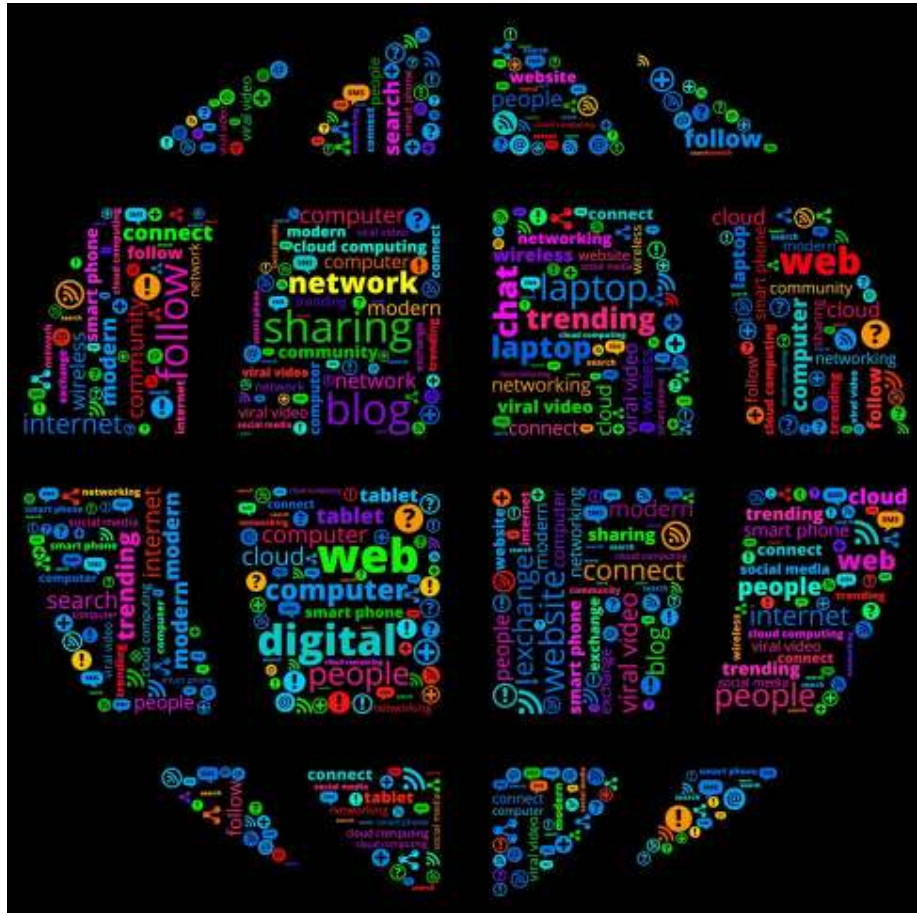
Circle Economy

Re-utilization of residues and by-products

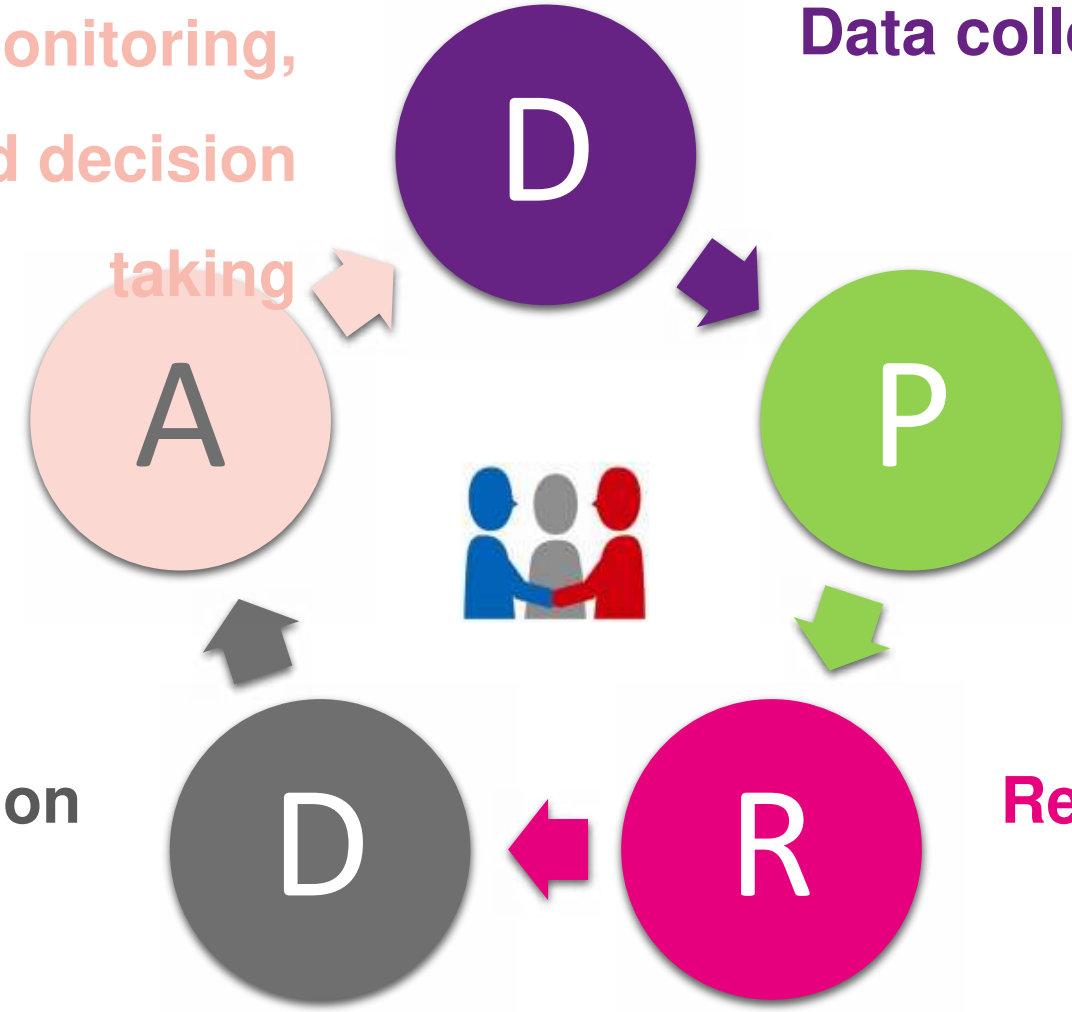
anterra capital
Transforming the way we produce, move, and consume food
Global Forum for Innovations in Agriculture
May 2017
Global forum for innovations in agriculture
2017 | UTRECHT | THE NETHERLANDS
9-10 May: Jaarbeurs Expo Centre
Supported by
Sponsored by
Rabobank
Science For A Better Life
IBMA
planet.
GODAN
Global Open Data for Agriculture & Nutrition
In cooperation with
Proagrica
tff
NABC
CTA
IFOAM ORGANICS
syngenta
LTO Nederland
Department for International Trade
CEMA

Digital Economy?

- It's of course digital
- Knowledge economy
- It's virtual
- Interconnected
- Promotes des-intermediation
- Innovation
- Inmediacy
- Globalization
- Digital breach



The 5 steps in an Information System



Data collection

Processing

Reports generation

Distribution

Analysis / monitoring, prediction? and decision taking

11:27
Documents
PC_Mating_EN_02
Documento fechado e enviado.
Obrigado
#144836
PC_Mating_EN_02
Documento fechado e enviado.
Obrigado
#144835
PC_Mating_EN_02
Documento fechado e enviado.
Obrigado
#144834
PC_Mating_EN_02
Documento fechado e enviado.
Obrigado
#144744
PC_Mating_EN_02
Documento fechado e enviado.
Obrigado
#144742
PC_Mating_EN_02
Documento fechado e enviado.

Pro Europa
FarmSense

NAUTIZ X4
PigCHAMP Mo
17:08
Operator
2
Password
001S - SOW1 (550)
2.0.0.127
Sign On
Cancel
OK
handheld
F1
F2
F3
F4

Farmers' benefits

Better quality of crops and increased yields!

Increase profits!

Decrease negative impact on the environment!

Reduce costs!

Prevent soil destruction!

Reduce water use!

Reduce pesticide usage!

Increase accuracy of observation!

Improve production processes planning!

Improve machinery usage!

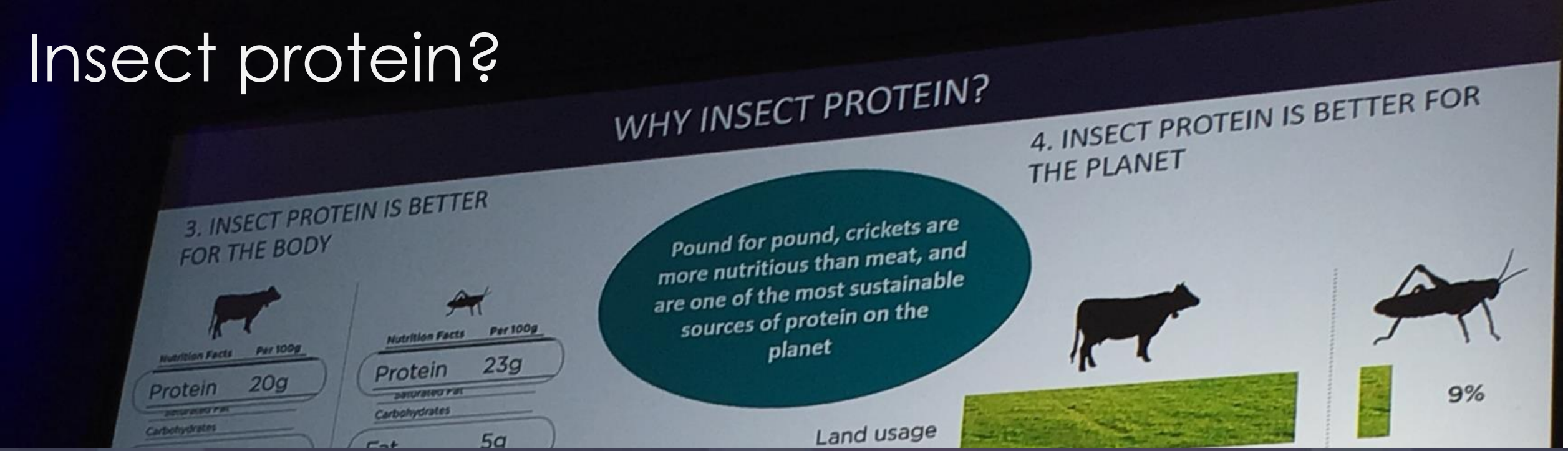
WE CONVERT SPACES INTO VERTICAL FARMS

WE BUILD ULTRA-EFFICIENT MODULAR FARMS RIGHT IN THE HEART OF THE CITY, THAT ARE RESPONSIVE TO THE GROWING DEMAND FOR LOCAL, TRANSPARENT, AND DYNAMIC FOOD PRODUCTION.

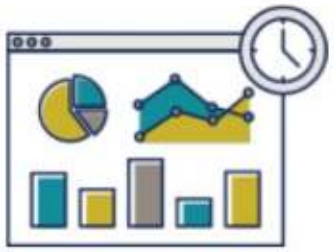
THE INFARMERS

WE ARE A TEAM OF PLANT SCIENTISTS, ROBOTICISTS, INDUSTRIAL DESIGNERS, IT WIZARDS, ARCHITECTS, FUTURISTS AND CHEFS. ALL SHARING A PASSION TO HELP SHAPING THE FUTURE OF CITIES.

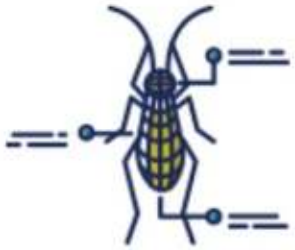
Insect protein?



Precision Farming: From Hatch to Batch



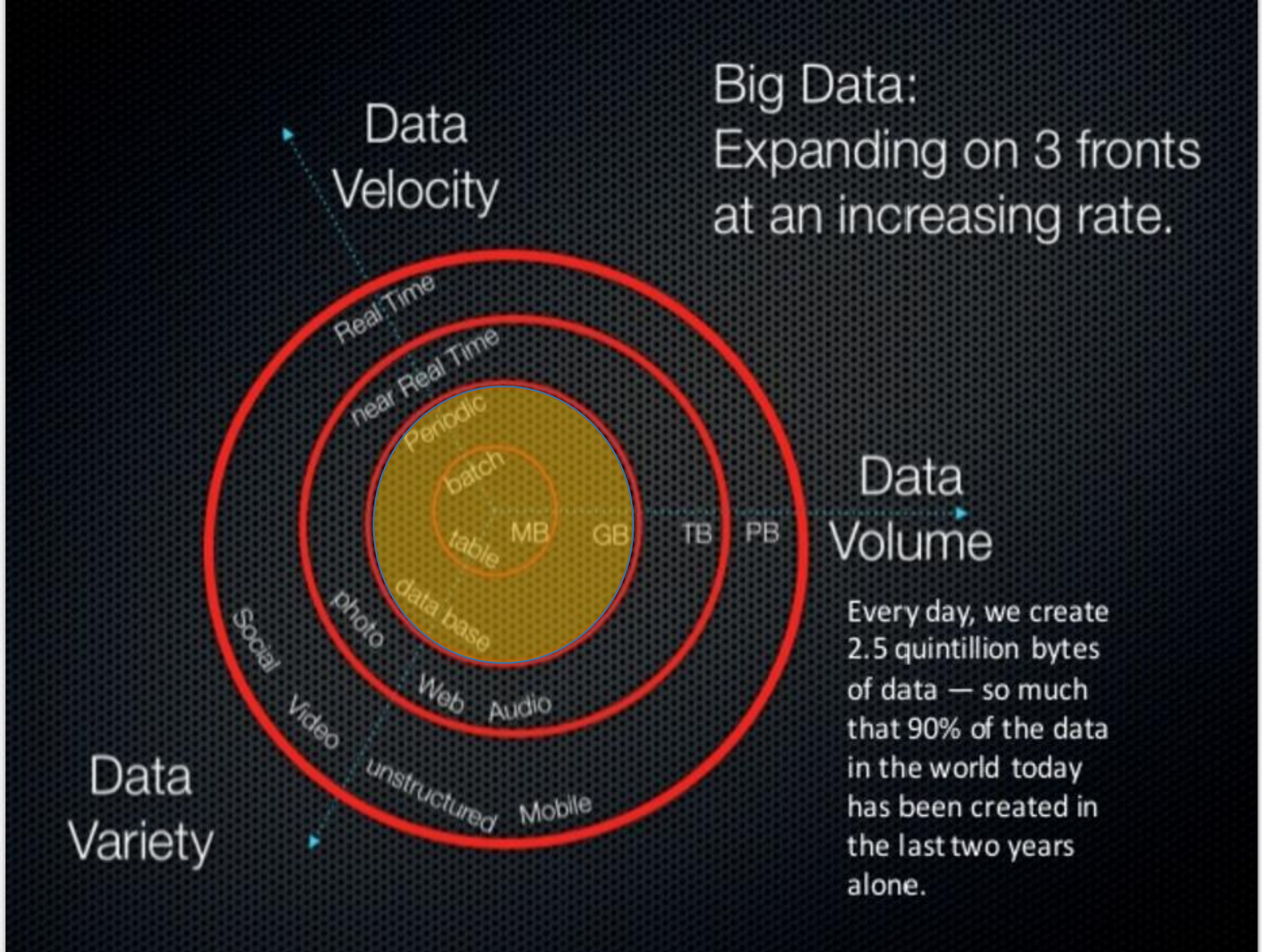
We put the "precision" in precision-farming by deploying proprietary sensor technology and internet-of-things (IoT) to capture real-time data on our insects from hatch-to-batch.



We apply complex modeling simulations and analytic approaches to our data to optimize our techniques to take our farming technology to new heights.

We are in the process of implementing zero-waste systems throughout our farm to ensure we adhere to our rigorous standards of sustainability.

And where is swine industry now?



Finally,

Can we predict diseases or anticipate problems through data?

Collectively obsessed with prediction

Bow deities in the past

Emptying pockets for palm readers

Hearken for horoscopes and love astrology

For prediction we need data

- *And we have data, some*
- *Data = Sows data?!*
- *Very likely not enough in terms of quantity, quality and mainly, variety*
- *And we need them fast…*
- *And we need them within an information system*

The Decision Makers: Econs or Human?

ECONS

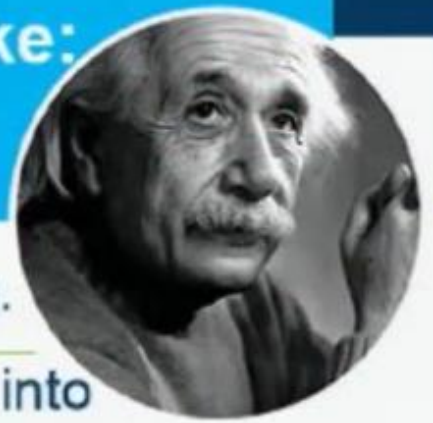
Have a multi-dimensional utility curve for everything.

Enter all known variables into their utility function.

Assign probability distributions for uncertainties.

Choose a course of action which maximizes their expected utility.

Think like:



Have the memory of:

And the patience of:

HUMANS

Can't do complex calculations.

Are influenced by all kinds of biases.

Make decisions that are not optimal.

Reference: "Nudge", Richard Thaler and Cass Sunstein, Yale University Press

Published May 15, 2015

High lifetime and reproductive performance of sows on southern European Union commercial farms can be predicted by high numbers of pigs born alive in parity one[1]

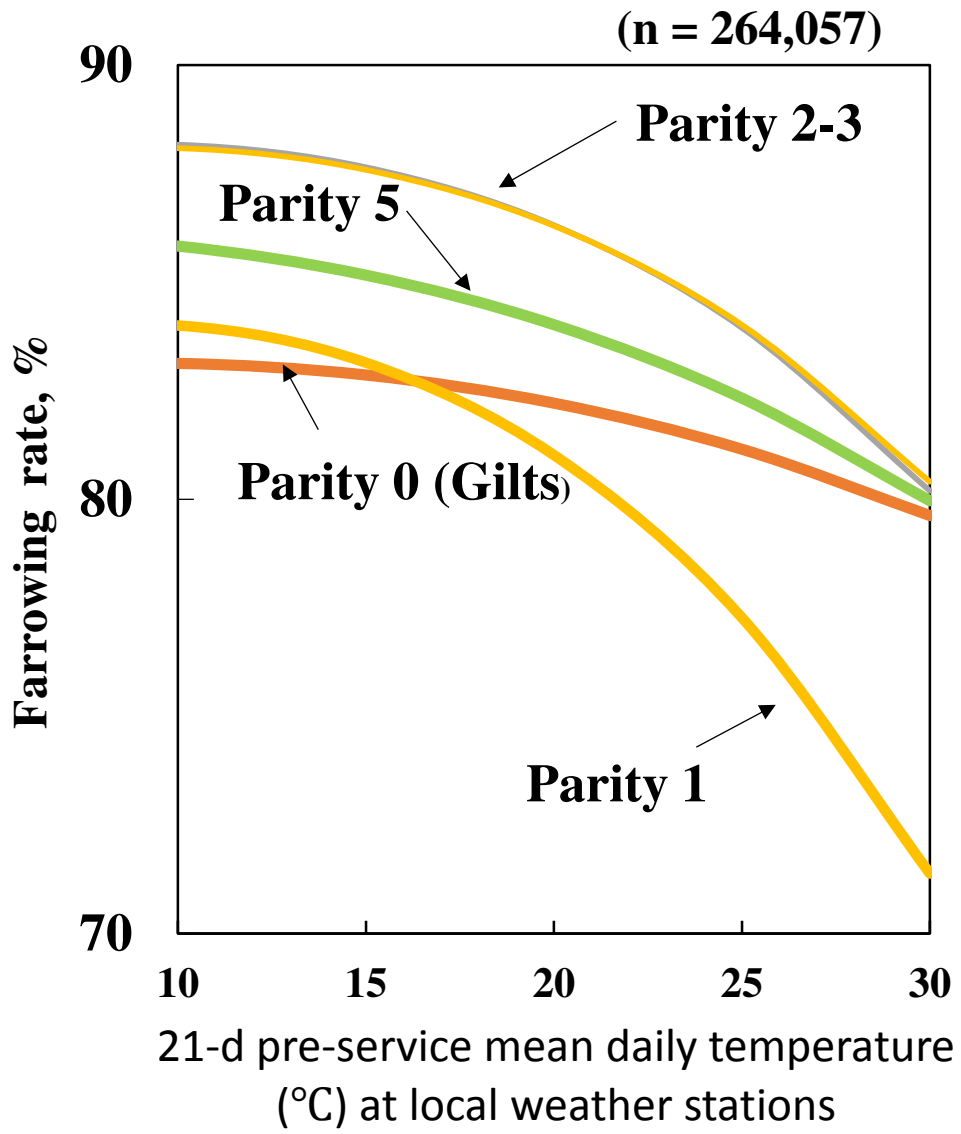
R. Iida,*[2] C. Piñeiro,† and Y. Koketsu*

*School of Agriculture, Meiji University, Higashi-mita 1-1-1, Tama-ku,
Kawasaki, Kanagawa 214-8571, Japan; †PigCHAMP Pro Europa S.L., c/Santa Catalina 10, 40003 Segovia, Spain

doi:10.5539/jas.v9n4pxx URL: https://doi.org/10.5539/jas.v9n4pxx

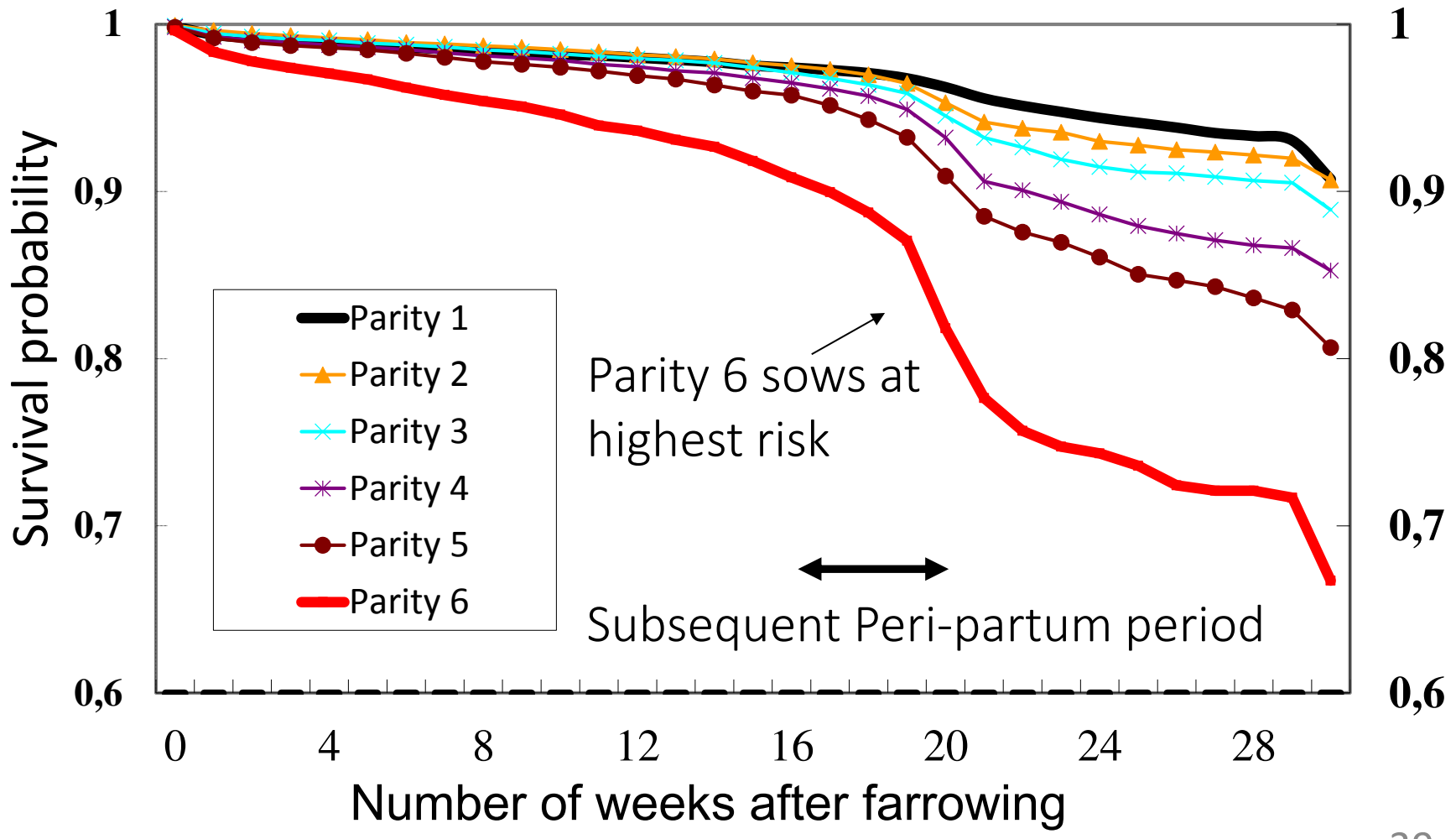
Kanagawa 214-8571, Japan; †PigCHAMP Pro Europa S.L., c/Santa Catalina 10, 40003 Segovia, Spain

Increased Outside Temperature Reduces Farrowing Rate (FR, %) –especially Parity 1



- Parity 1 sows more sensitive to temperature rise than other parities
- FR decreased 10% in parity 1 as temperature rose from 20 to 30 ºC
- Associated with lower lactation feed intake in summer
- Can predict likely FR decrease for each parity

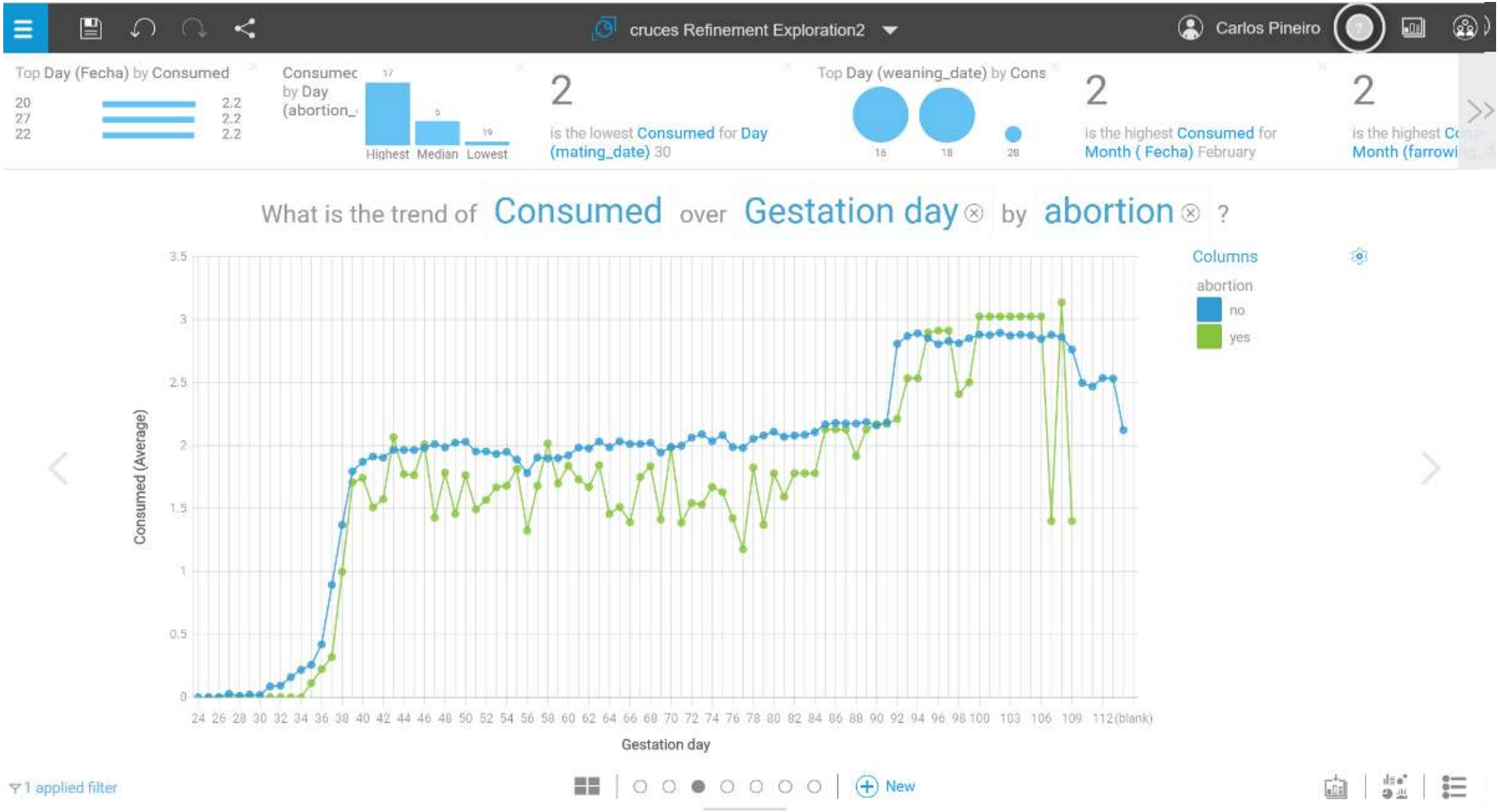
Survival after Farrowing: Aged Sows are at Higher Risk



Sasaki and Koketsu, JAS, 2008

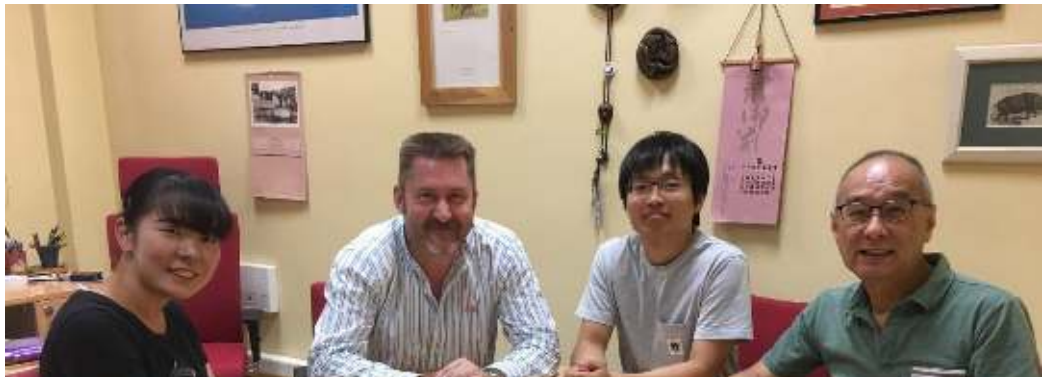
Crossing data : Electronic Sow Feeding x Reproductive data

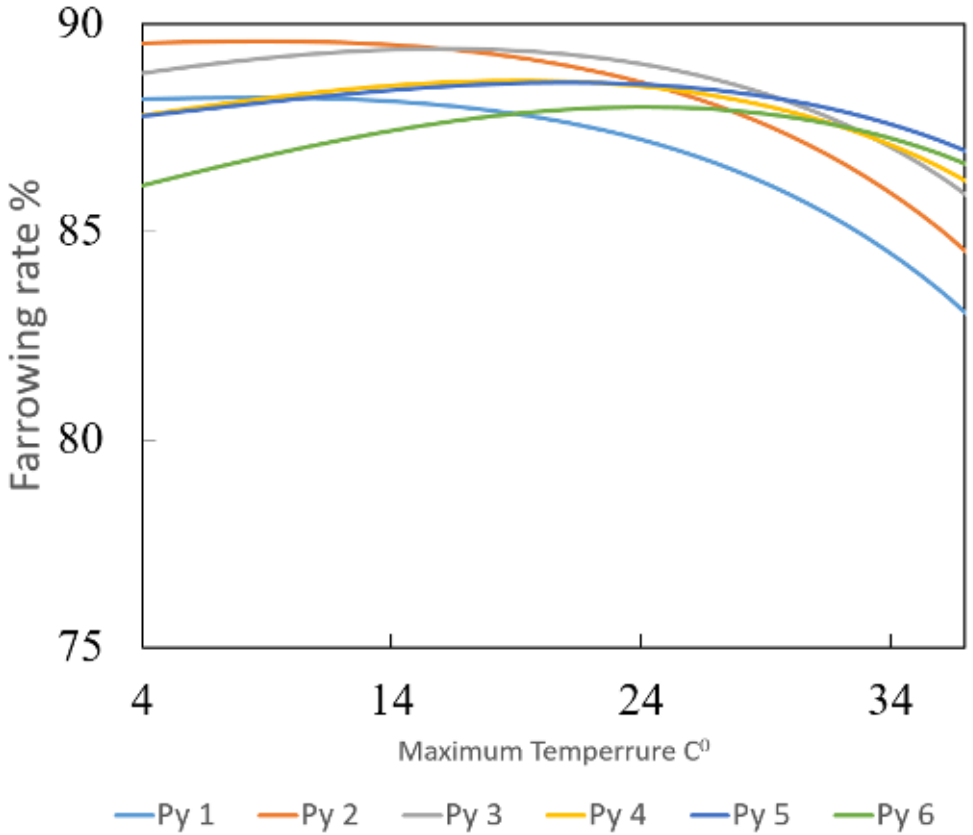
Which is the feeding behavior of sows that will have an abortion?



Predictive model in Reproduction (PigCHAMP GROUP)

Combination of historic data and local weather stations

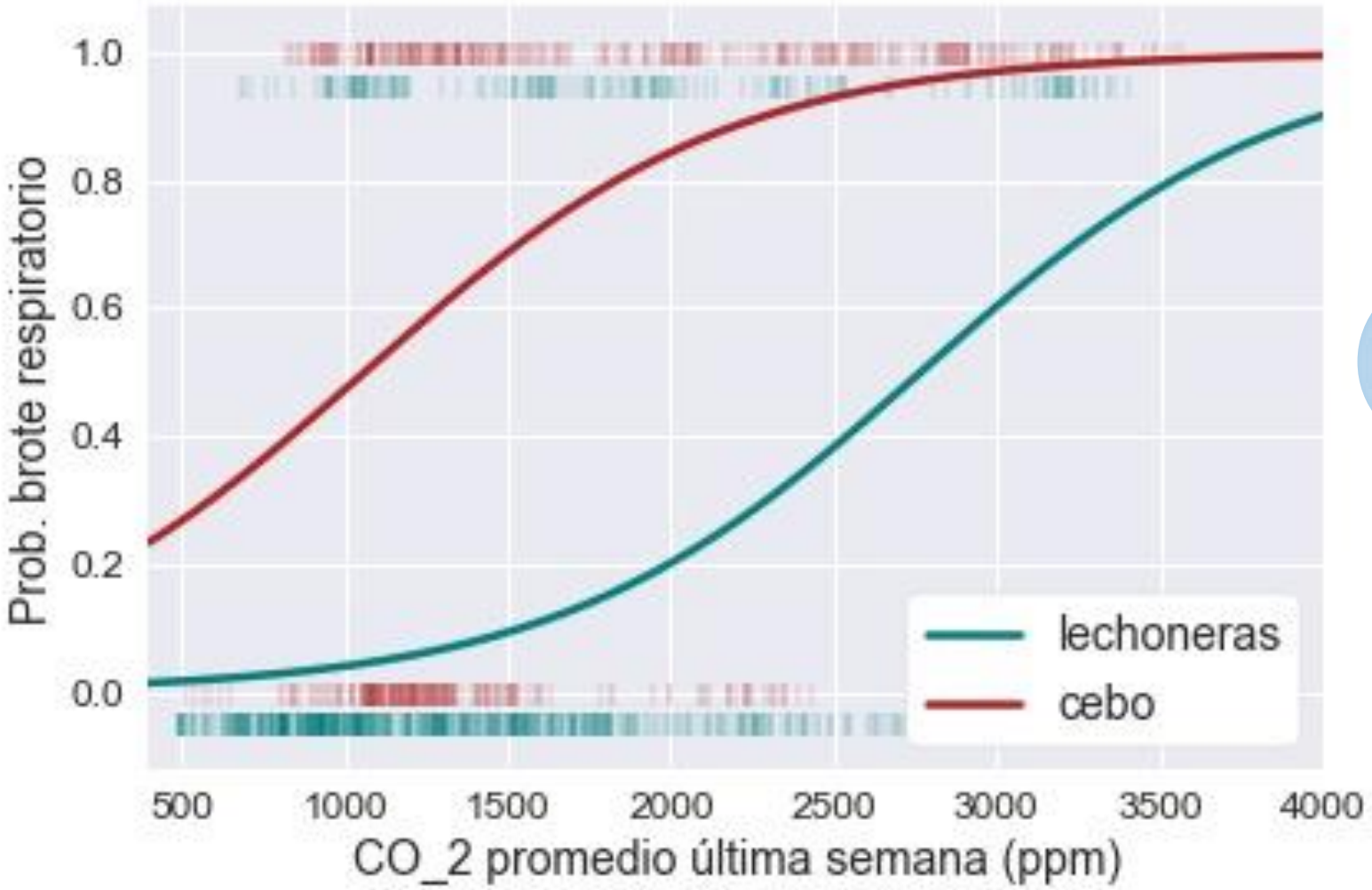


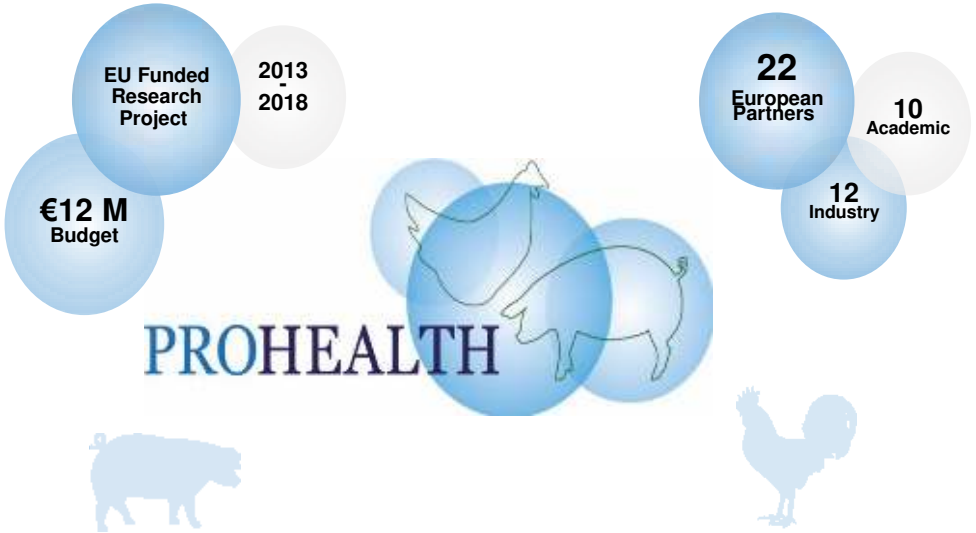


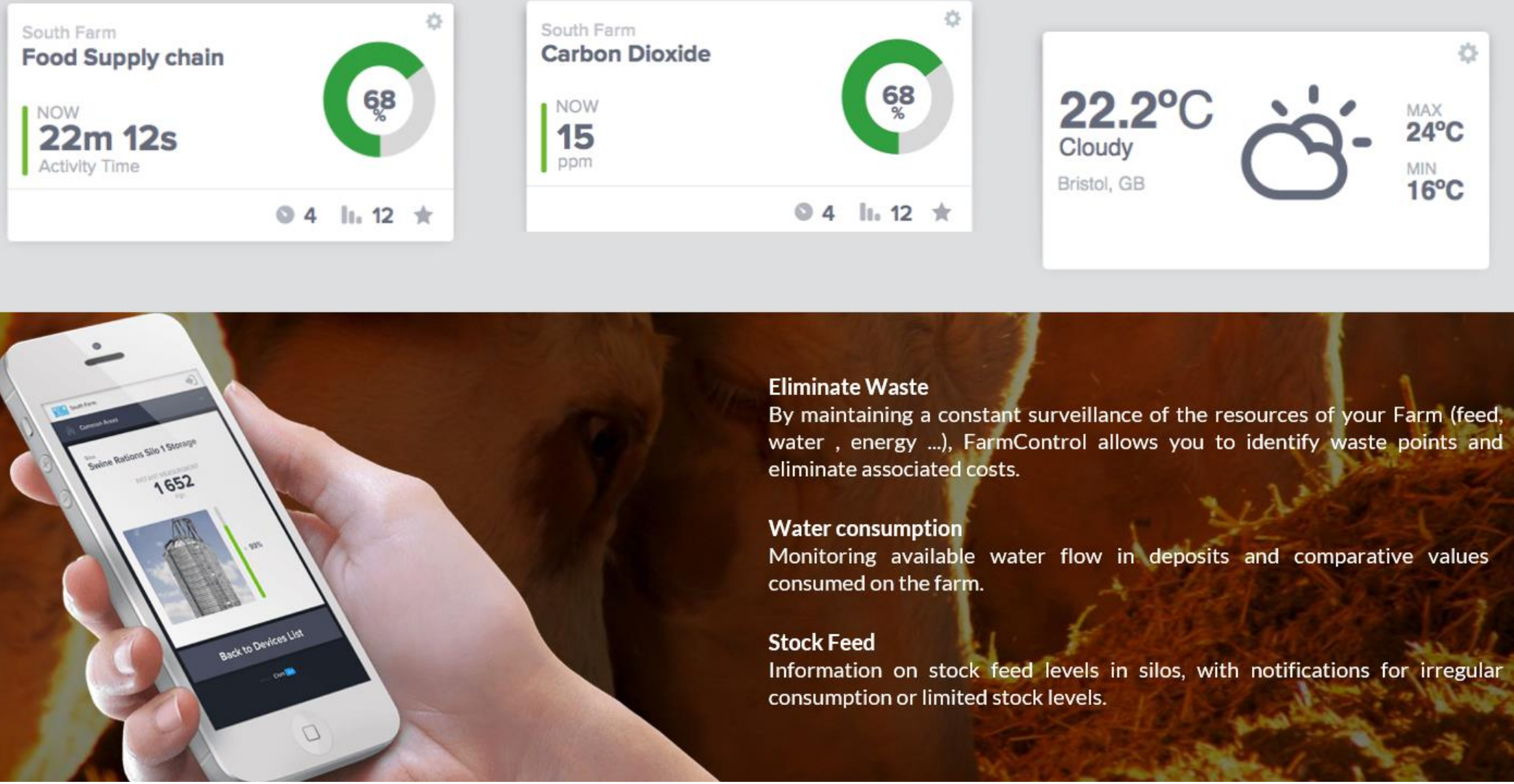
Prof. Koketsu, U de Meiji, Tokyo

Respiratory outbreak prediction model (PigCHAMP GROUP)

Effect of CO_2 of the prior week



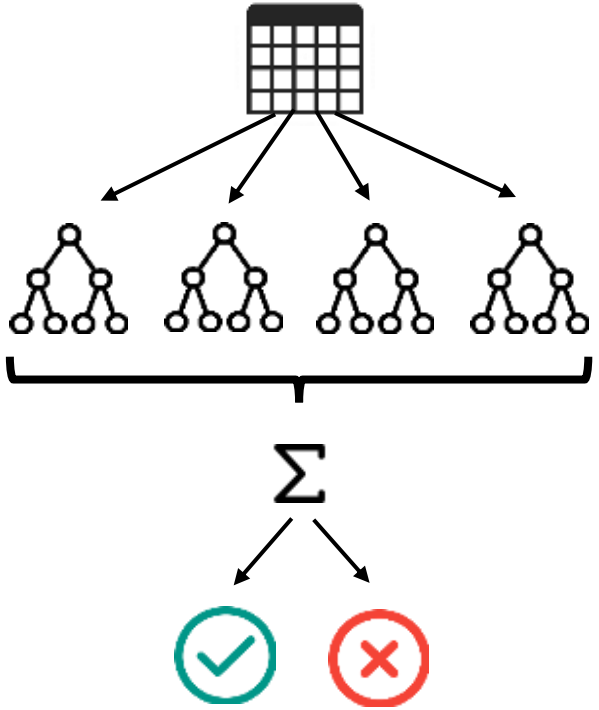



South Farm
Food Supply chain
NOW
22m 12s
Activity Time
68 %
4
12
South Farm
Carbon Dioxide
NOW
15
ppm
68 %
4
12
22.2°C
Cloudy
Bristol, GB
MAX
24°C
MIN
16°C
Swine Rations Silo 1 Storage
1652
Back to Devices List
Eliminate Waste
By maintaining a constant surveillance of the resources of your Farm (feed, water , energy ...), FarmControl allows you to identify waste points and eliminate associated costs.
Water consumption
Monitoring available water flow in deposits and comparative values consumed on the farm.
Stock Feed
Information on stock feed levels in silos, with notifications for irregular consumption or limited stock levels.

Prediction of disease outbreaks?

- Using more sophisticated model ***Machine Learning and Deep Learning***.

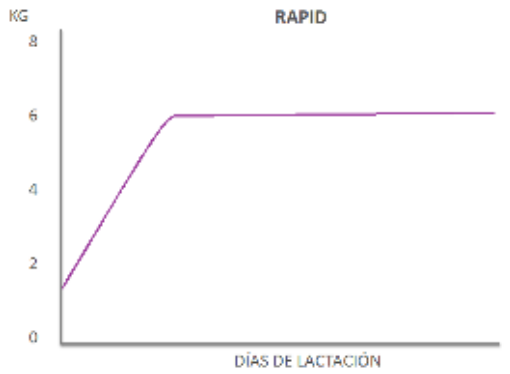
Random Forest: Prediction is an average of predictions of a set of random decisión trees over the variables

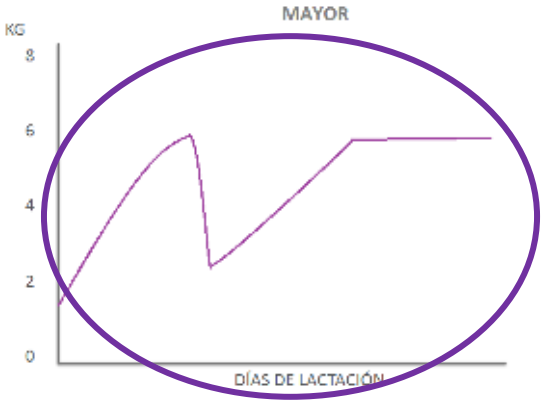


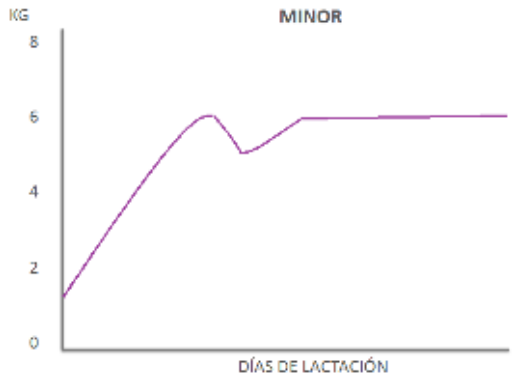
Radom forest

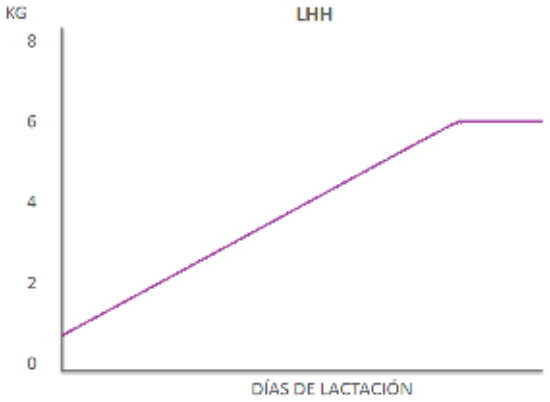
- Just environmental data

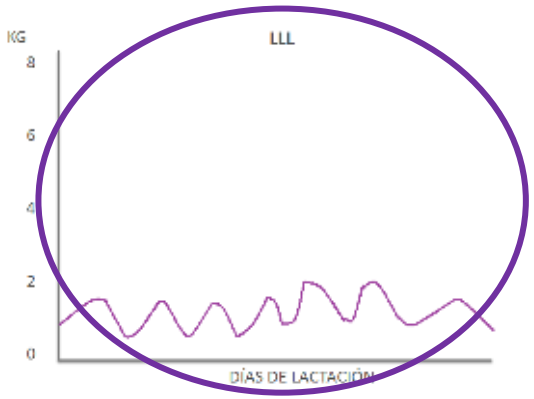
Data \ Model	✓	✗
✓	119	26
✗	13	280
Accuracy	91.2%	

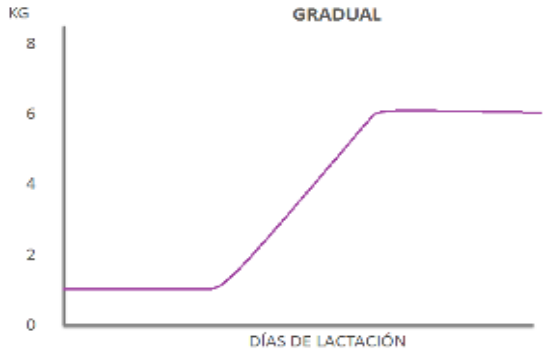










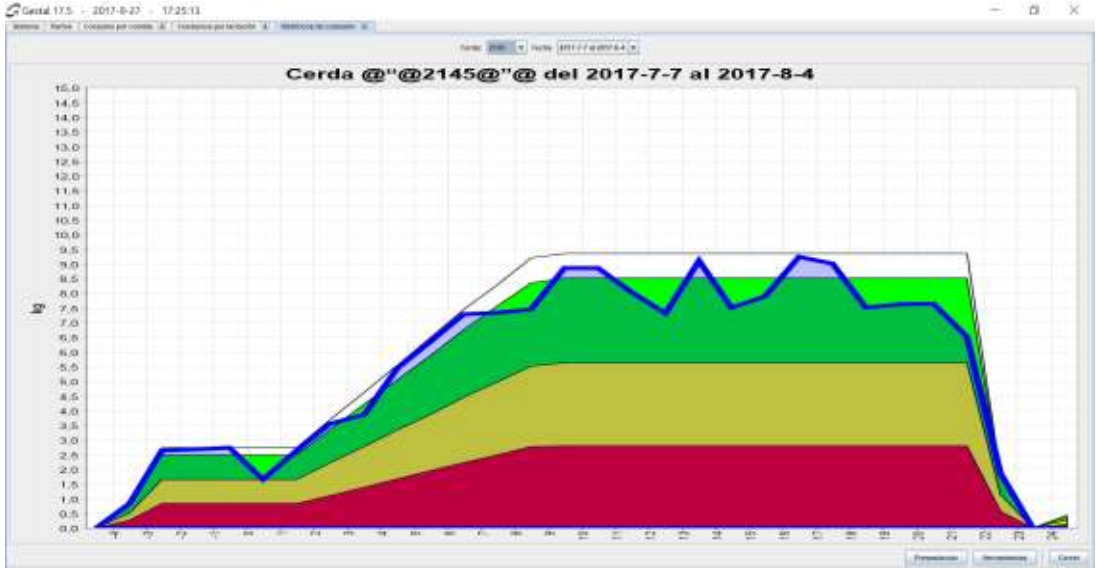


6 Feed intake patterns in lactation

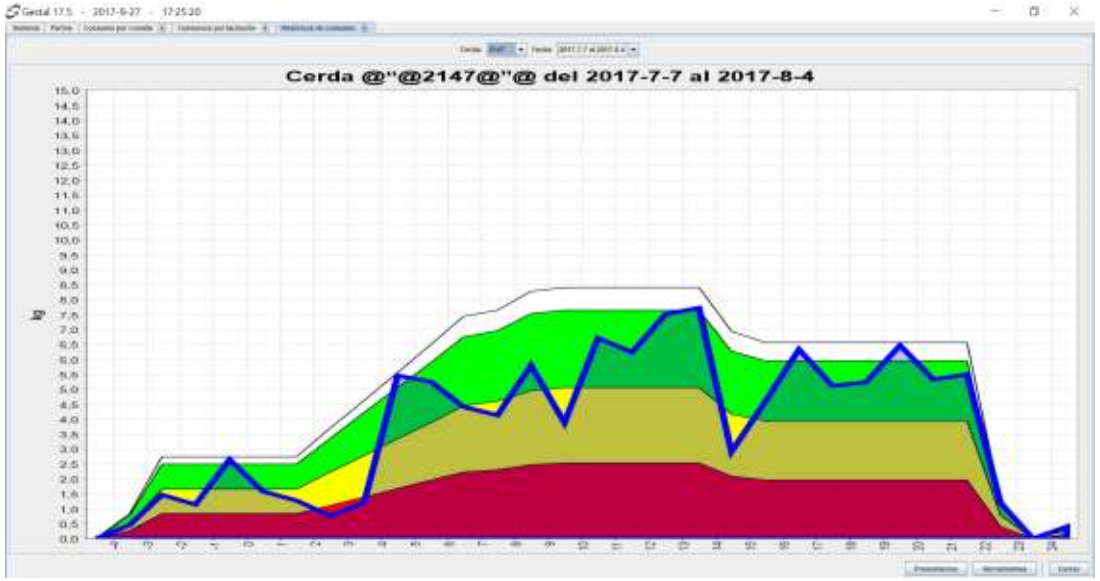
That matters!

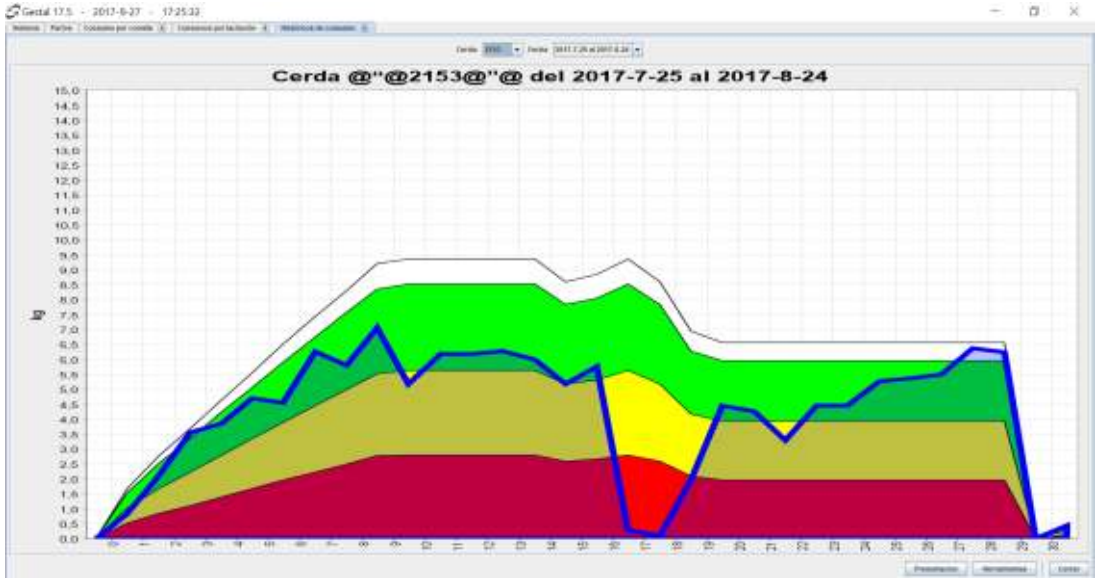
Some of them are risky for later sow performance

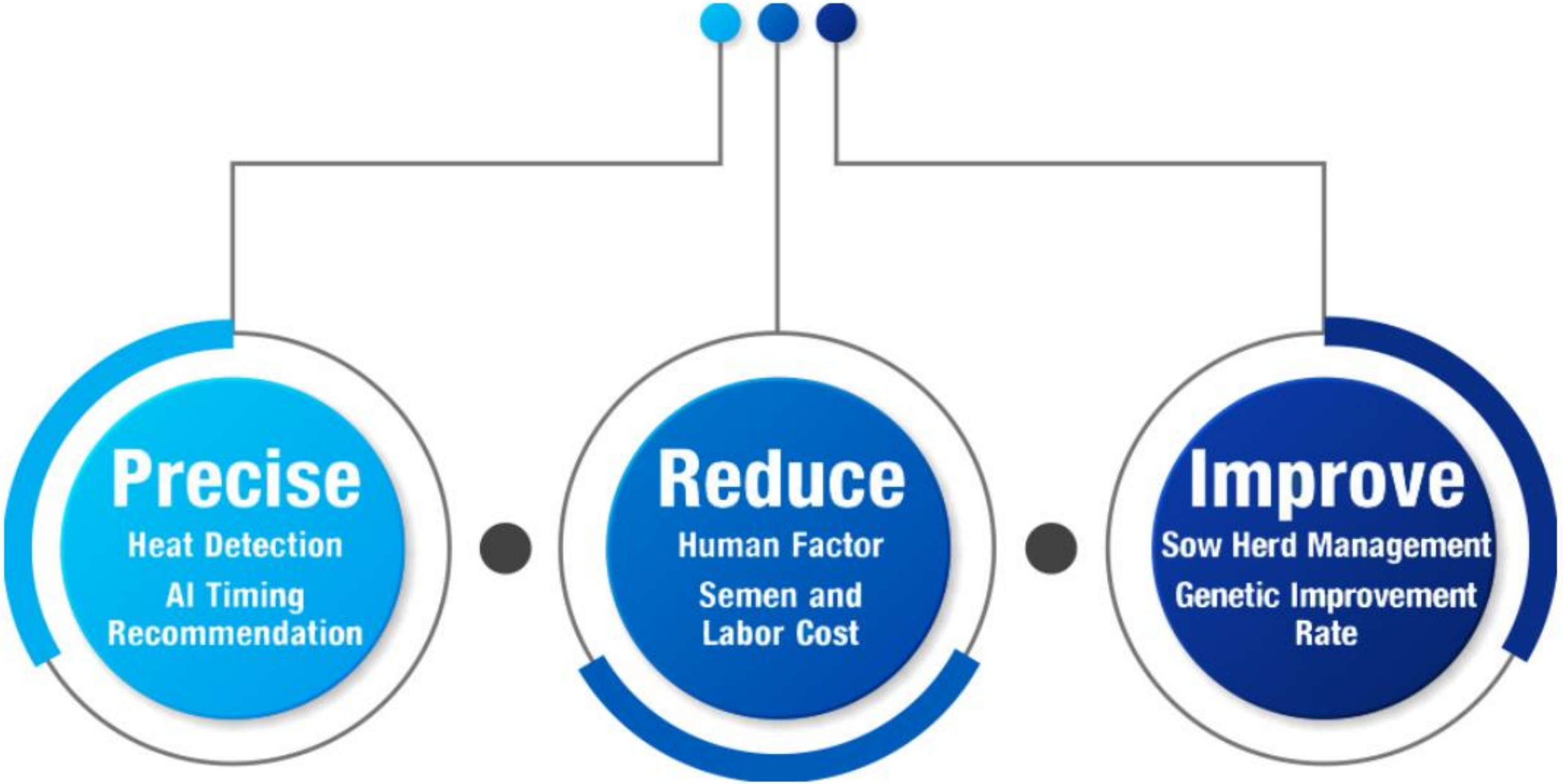
Koketsu et al., Journal of Animal Sci., 1996



3 different intake patterns in lactation. What do we see here?





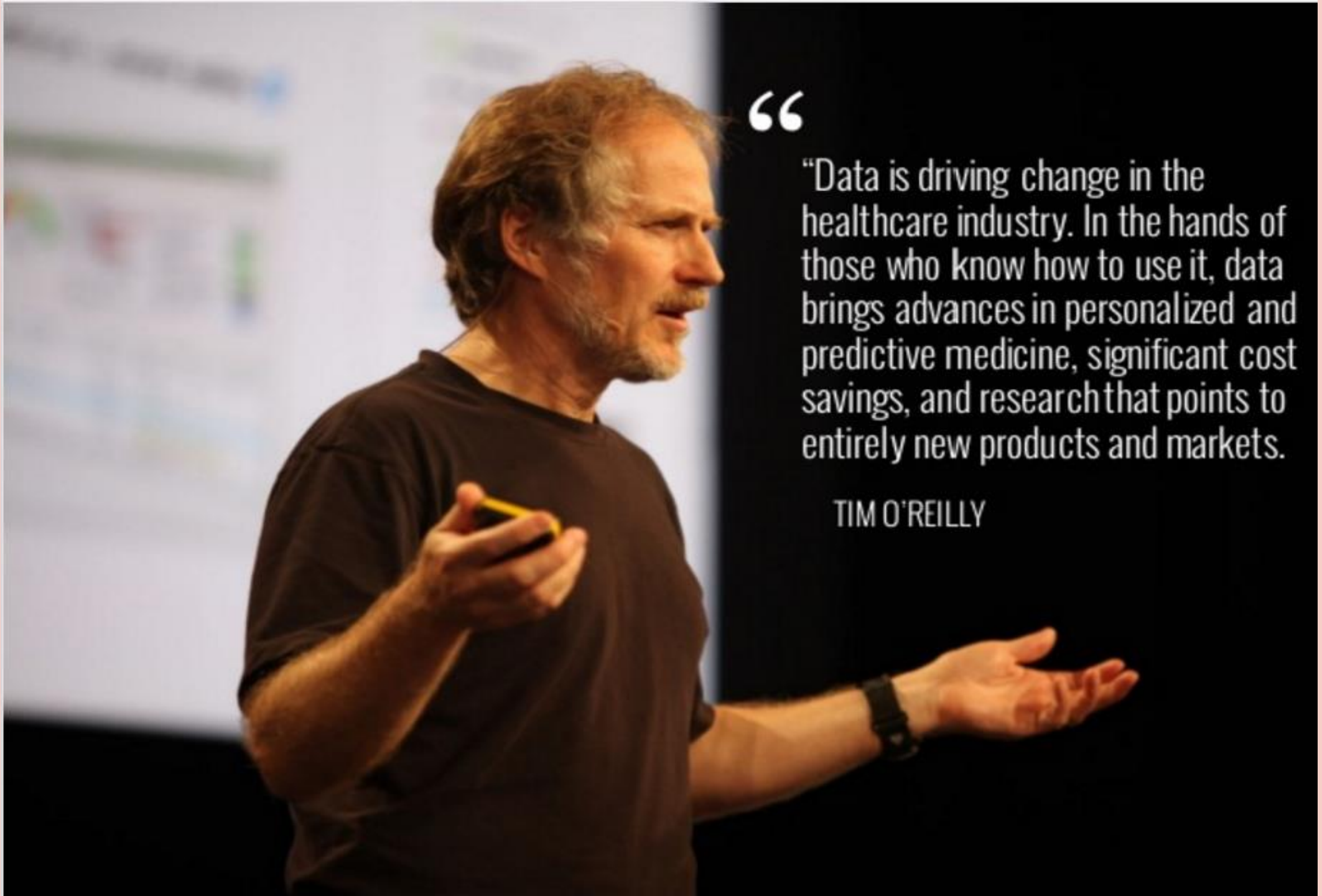


Precision breeding through artificial intelligence

The good new is that will likely happen

But we will need

- More data of the kind we have already (reproduction & health)
- Other sources (Biosecurity, Weather, Environmental, human behaviour) going really Big Data
- Other tools (cognitive intelligence)


“
“Data is driving change in the healthcare industry. In the hands of those who know how to use it, data brings advances in personalized and predictive medicine, significant cost savings, and research that points to entirely new products and markets.
TIM O’REILLY

‘Digital transformation is not time of change is a change of a time’
J M Alvarez Pallete,
President of Telefónica

Saluda

nente a D. Felipe Sánchez Urbano, y le
o llegar su carta a los astronautas, s
programa no les permitía desplazarse
e incluye fotografía y autógrafo de lo
para esa Cofradía.

Apollo 11 Astronauts

Neil Armstrong

Michael Collins

Edwin E. Aldrin, Jr.

El Agregado Cultural
de la Embajada de los Estados Unidos
de América

Eduard Mattos

Saluda