Animal Data Analytics

Precision farming, IT and AI; What's on, what's new?

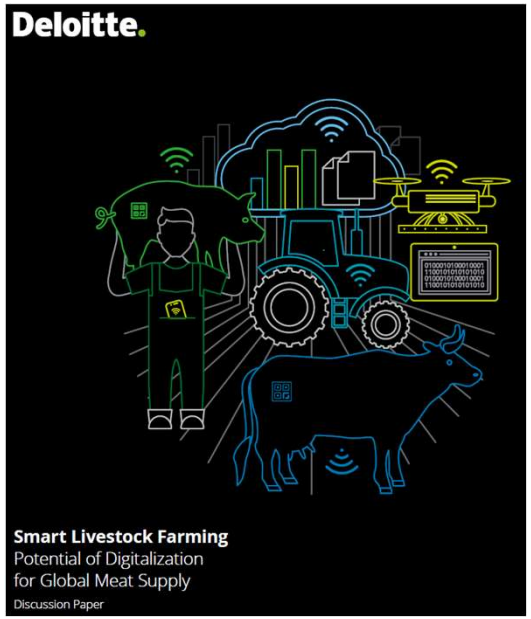
Carlos Piñeiro, CEO, PhD
Sevilla, June 17th 2023

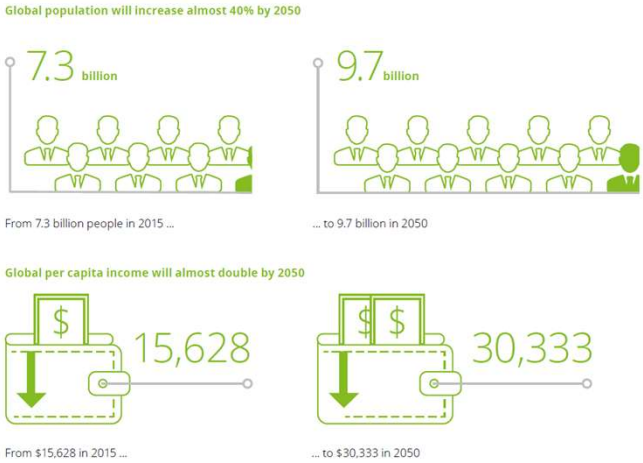
Content

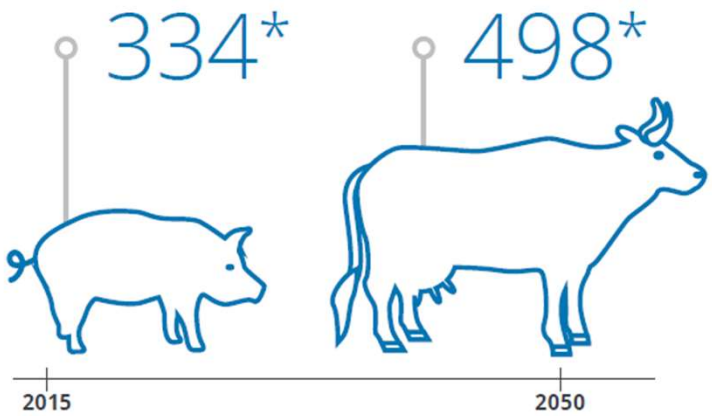
- Background; sustainability is only possible with digitalisation
- Less hype and go practical:
  - **Precision livestock feeding**
  - **Health and antibiotics real-time control**
  - **Digital biosecurity**
  - **Data Science**
- Take home : The key role of the vets and producers

KEY CHALLENGES IN THE MEAT PRODUCTION SECTOR

Increases in global population welfare are expected to lead to an increase in meat from 334 million tonnes in 2015 to 498 million tonnes* in 2050.







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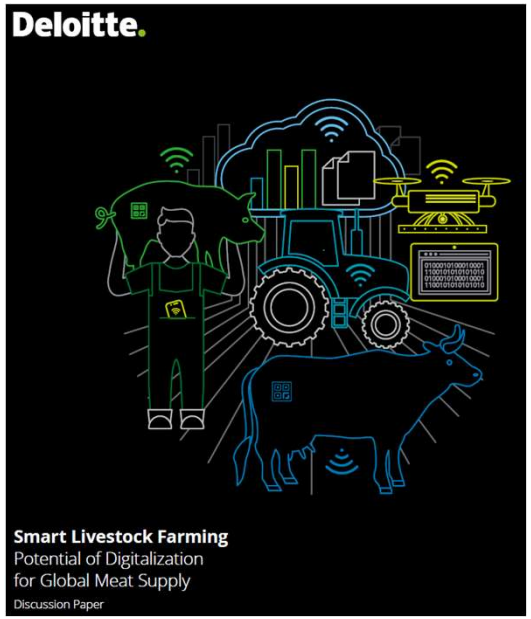
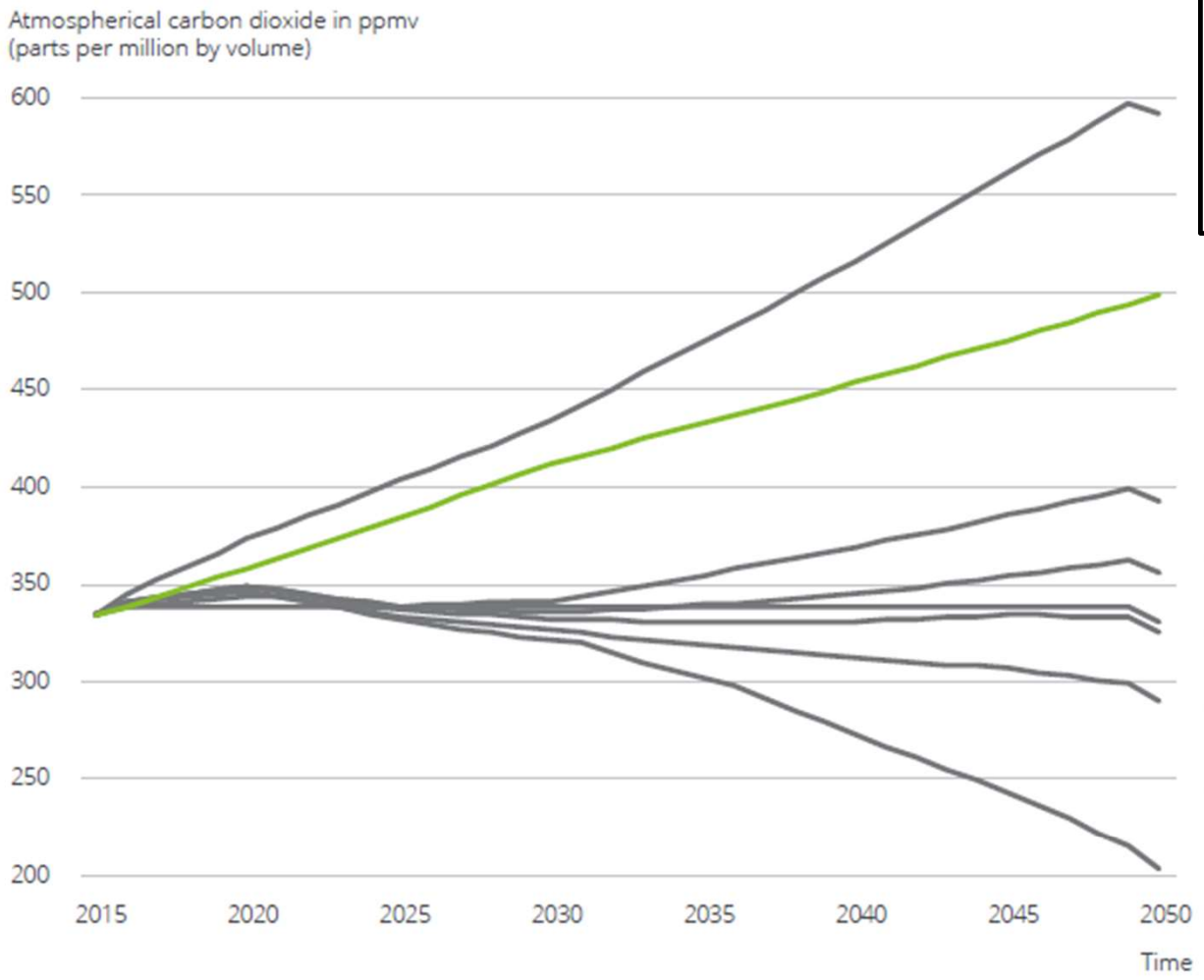


By available land and water, we can produce what we need, if there are no unforeseen events.

By emissions, we don't

Under the business as usual model, we will increase emissions for the productivity required. With the contribution of the meat sector to keep the **2° C máximum, we need to reduce our emissions to 3.2 GT** by 2050

Relationship between increased temperature and meat demand achieved in current production model



Demand – 498

CO_2 level (3.5°C) – 392

CO_2 level (3.2°C) – 355

CO_2 level as today – 331

CO_2 level (3°C) – 325

CO_2 level (2.6°C) – 289

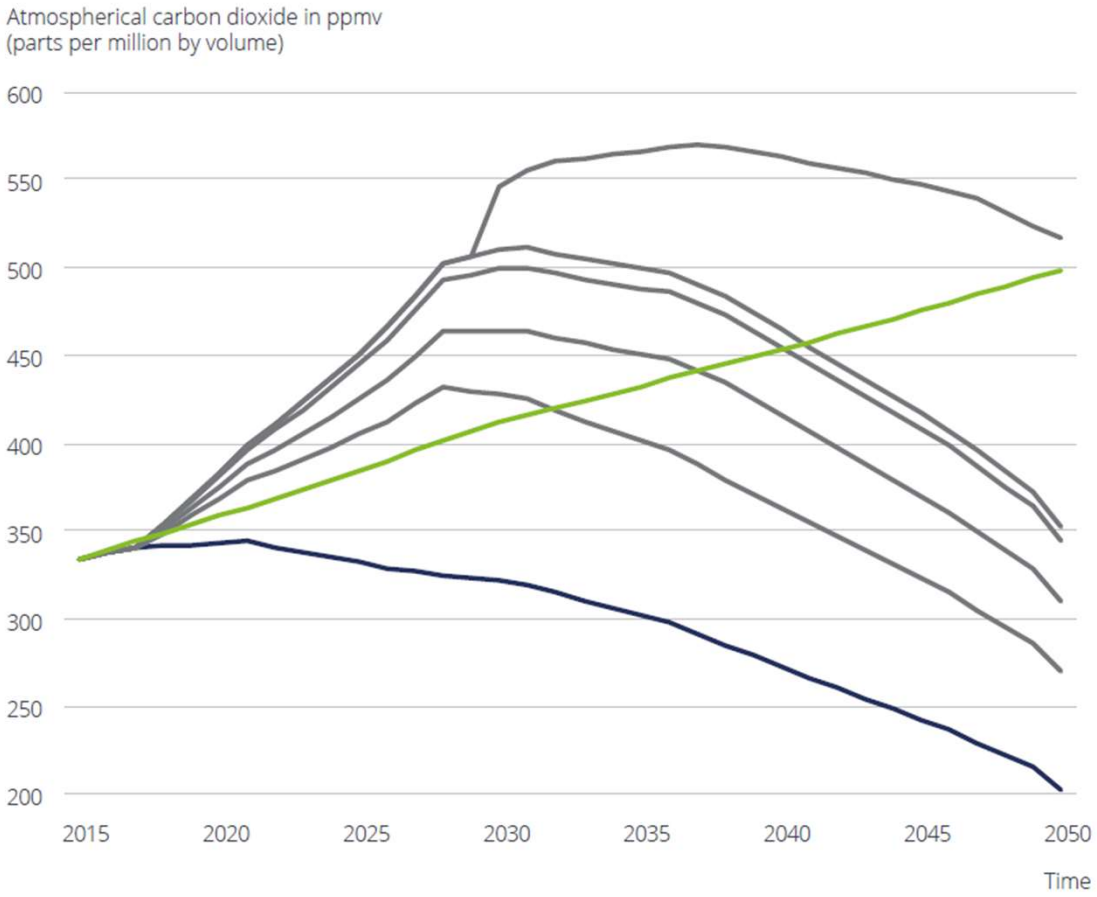
CO_2 level (2°C) – 203

59%

If global warming is to be kept within 2°C above pre-industrial levels, only 41% of global meat demand can be met by 2050

Deloitte, 2019

Solutions are complementary and cumulative



Beef reduction – 516
Demand – 498

Health monitoring – 353
Smart waste management – 344

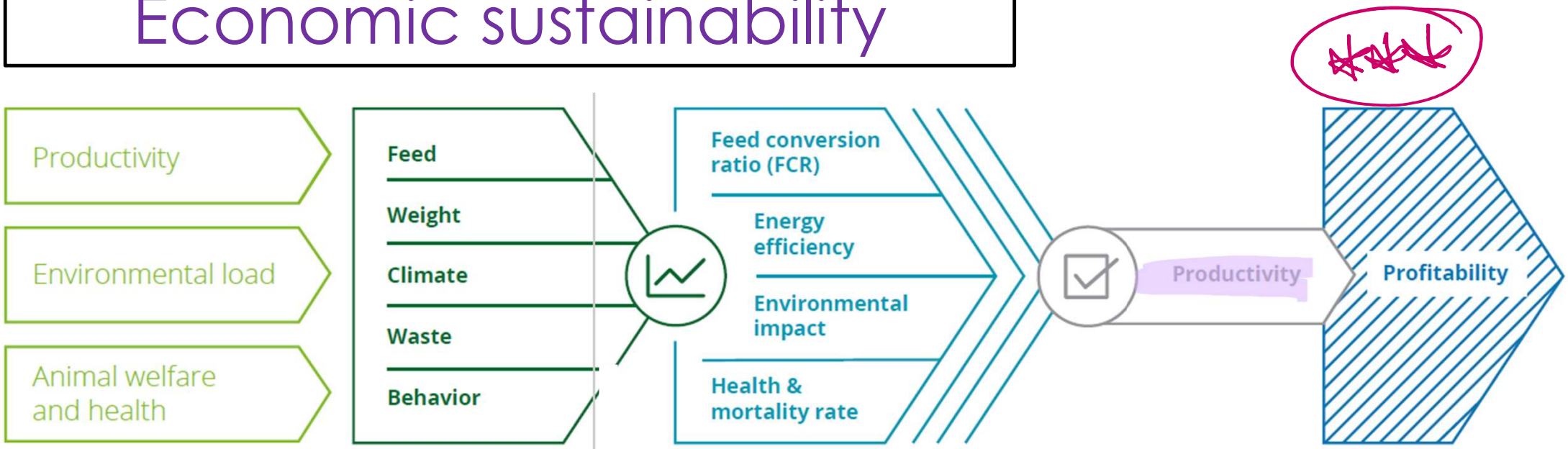
Precision feeding – 310

Best practice roll-out – 271

Business as usual – 203

In the context of a 2°C maximum increase we can only get with cumulative measures.

Economic sustainability



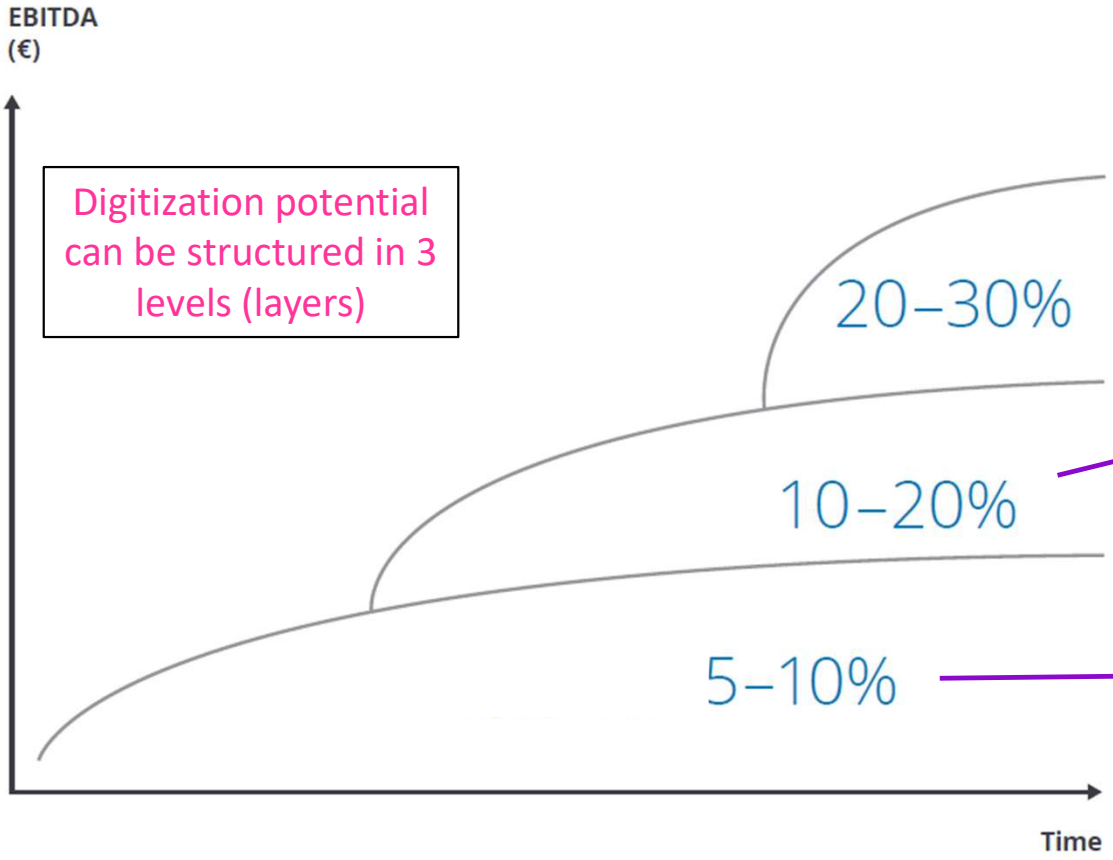
Precision power

Operations can be further improved when producers also share information gathered along the supply chain with stakeholders such as veterinarians, slaughterhouses, meat processors and feed producers.

In other words:
We will not be able to achieve these goals without technology

Deloitte, 2019

Digital business models improve companies'results



Digital business models
(customized services, pattern recognitions, prescriptive analytics, digital services of great added value)

Operations models based on data use
(Big Data, predictive analitics and the IoST)

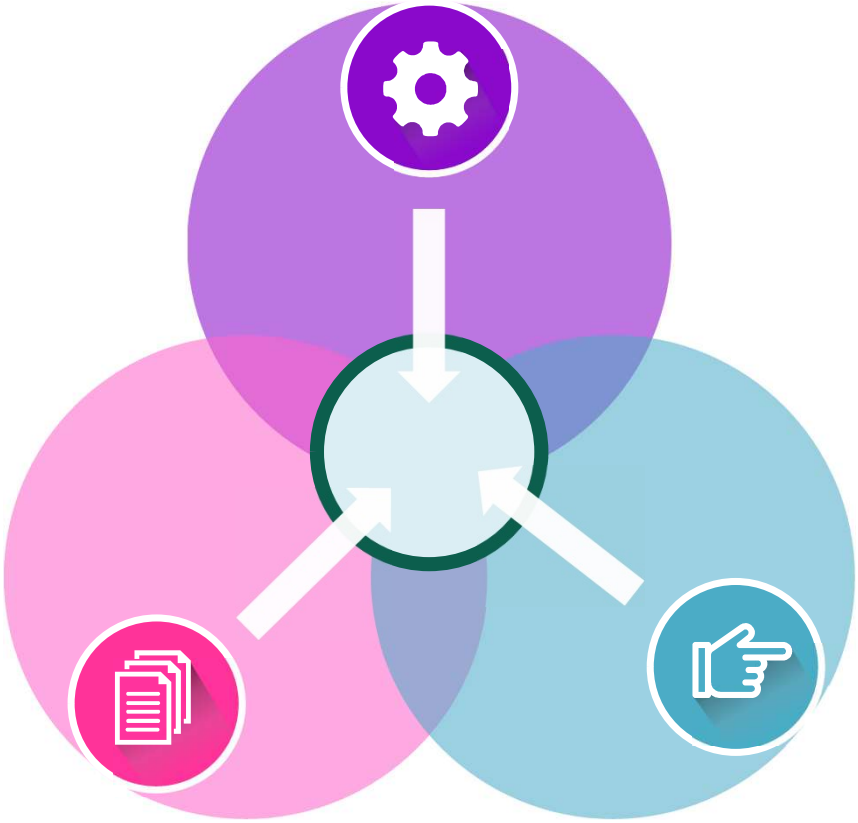
Tranparency and digital processing
(based on data generation)

Deloitte, 2019

Sustainability: Meeting the needs of the present without compromising those of future generations.

01 **Economic sustainability**

Management that ensures the profitability of activity over time.

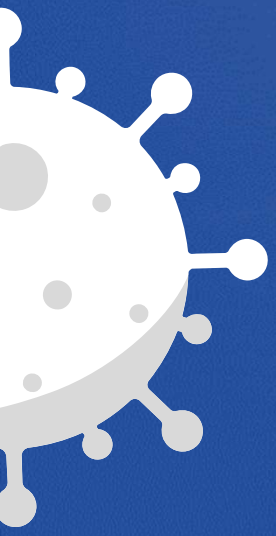


02 **Environmental sustainability**

Efficient management of natural resources (consumption and emissions) in the productive activity that allows their preservation for future generations.

03 **Social sustainability**

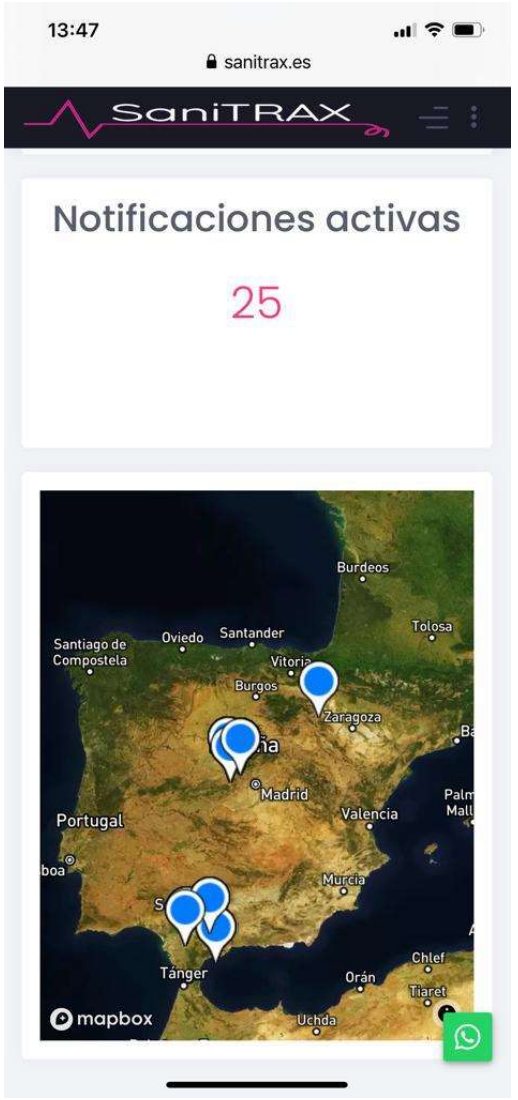
Actions that seek the cohesion of a population and its stability.



Farms’ visits are every day more difficult. We need a newfarms’ TELEMETRY

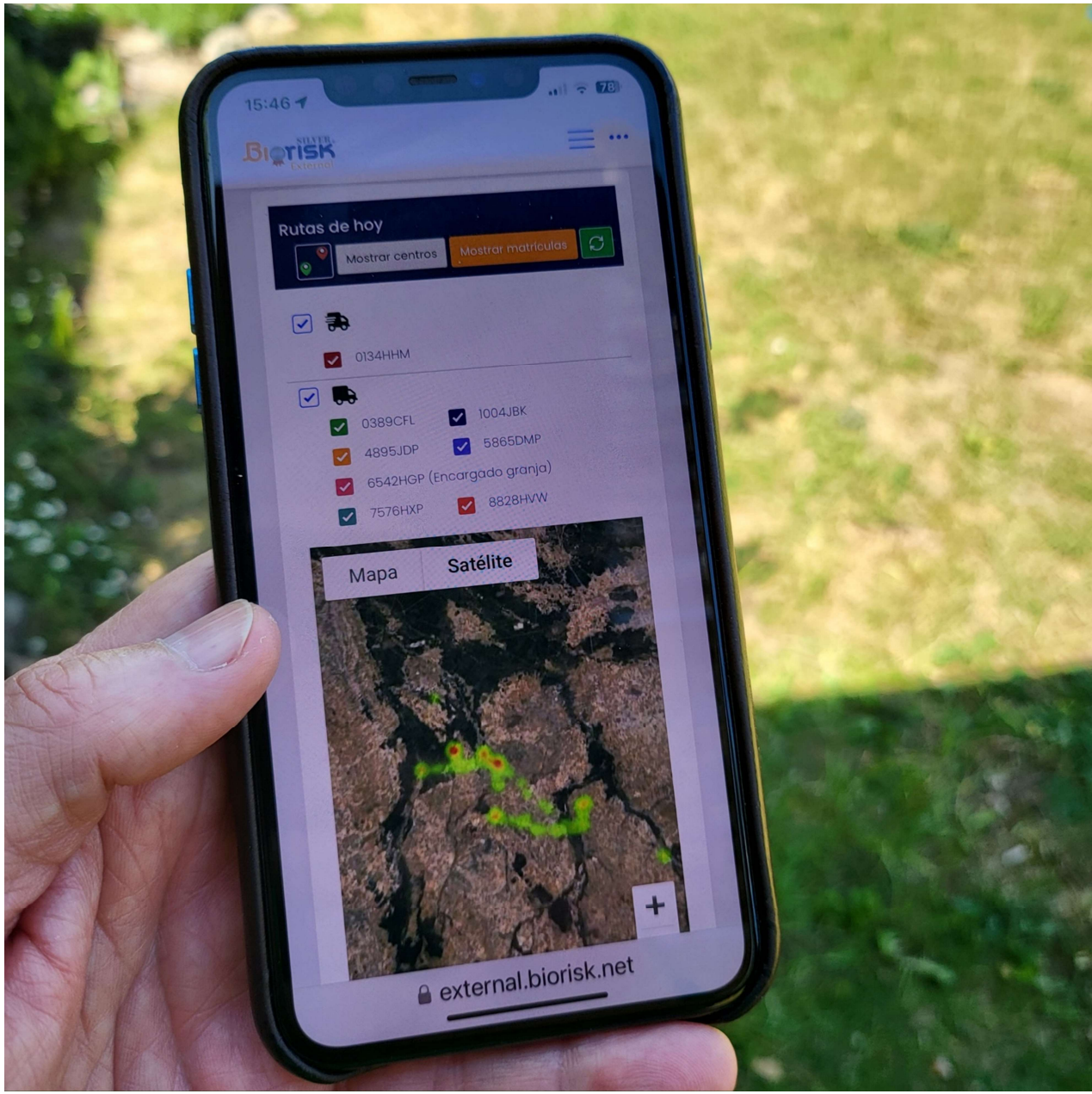
Human health (COVID-19)
&
Animal health
(PRRS, ASF, Influenza, Disentery,…)

Farms generate a new asset; data



The new farms telemetry

- Observational and equipment-generated on-farm data
- Cloud-local processing
- Our robust approach: 5 steps + 5 levels of information management
- Who does all this? The evolution of profiles in the sector and the generation of new ones.
- From doing little to doing almost everything: **sensible implementation of the change**



Three areas to start working

Electronic and precision feeding

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Health an antibiotics consumption

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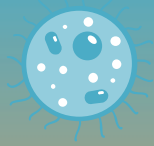

Digital biosecurity

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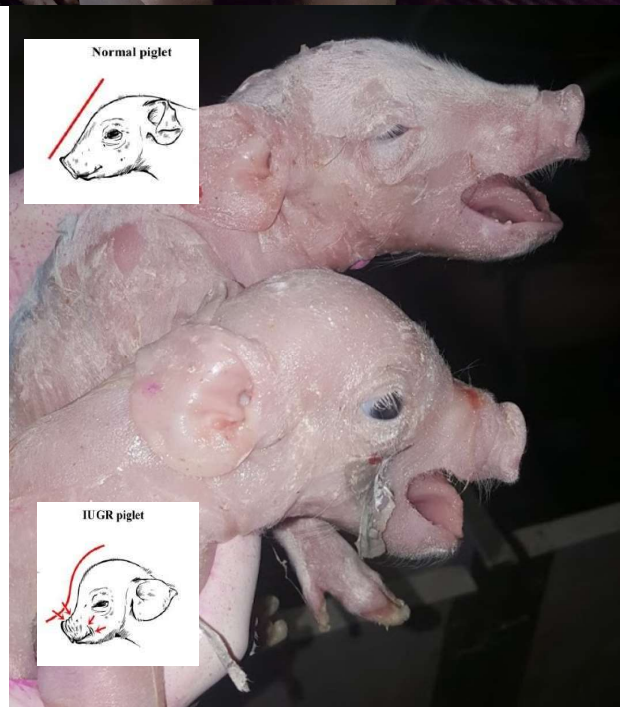
How can we get the best from sows?

Sow (re)productive performance has improved dramatically

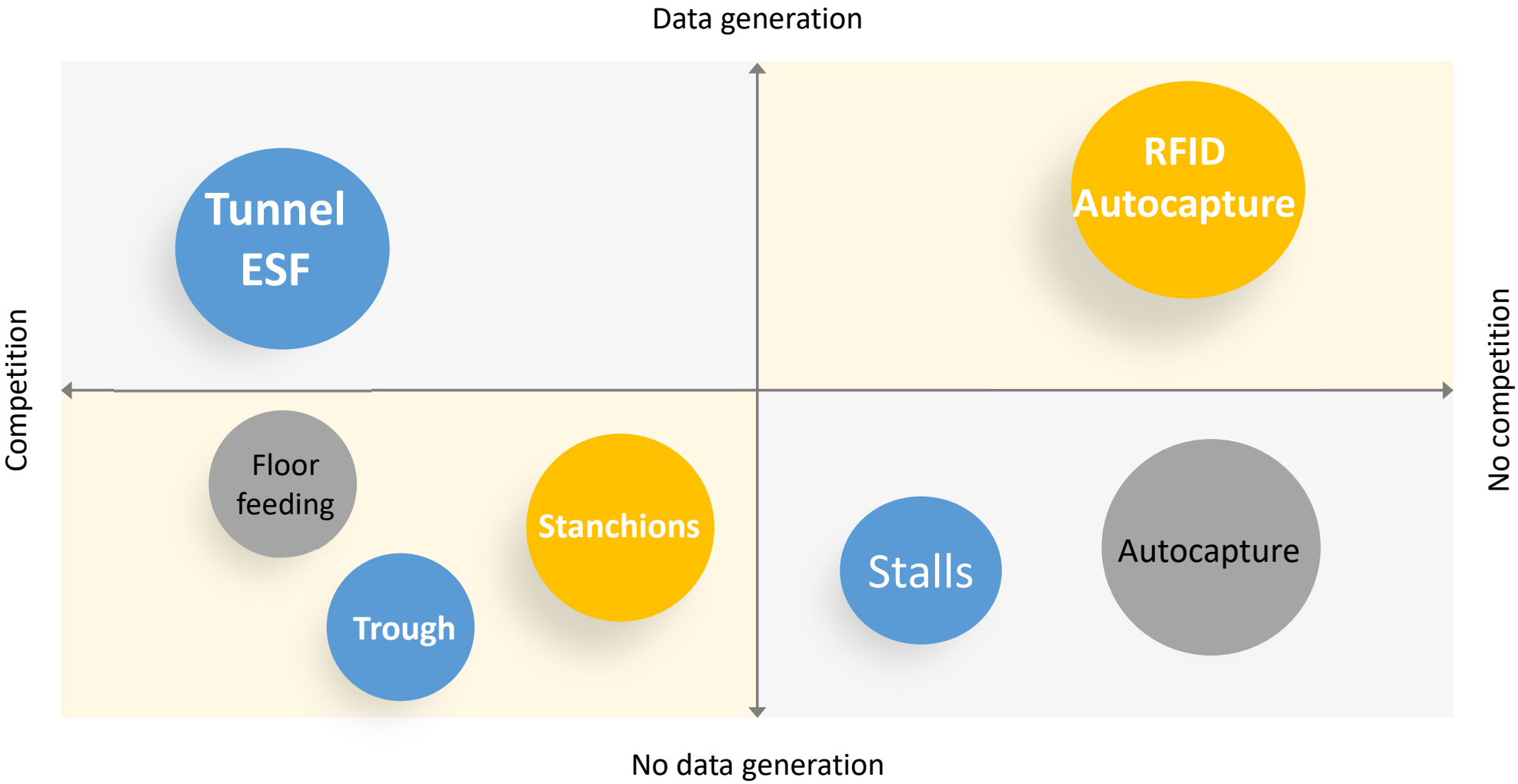
- **Higher weight as adult sows**
- ⇑ Maintenance requirements
- **Increased prolificacy**
  - ⇑ Requirements for foetal development (gestation)
  - ⇑ Milk production requirements (lactation)
- **No increase in intake**
  - Risk of energy and nutrient deficits
- **Higher variability in performance end requirements**
  - Between sows (farrowing, prolificacy, appetite…)
  - Between farms (genetics, health, facilities, management)
  - Climate and seasons

But there are also growing problems

- Increasing mortality / euthanasia in breeders (Tani, 2017)
- High annual turnover rates (50-65 %)
- Lack of homogeneity in litters
- Piglets at the limit of viability (IUGR)
- Pre-weaning mortality higher than ever
- Piglet survival rates not improved since the 1980s (83 %, IFIP, 2017)



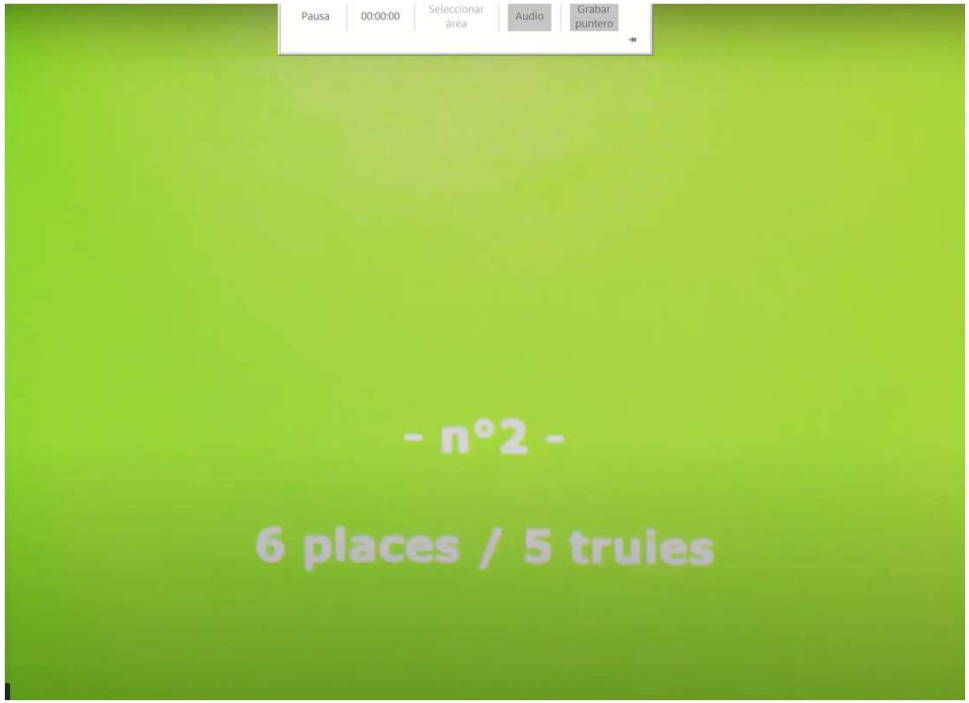
New classification of loose sows



Floor feeding

- Feed waste
- No control of body condition
- High stress

Trough



- Cheap
- No body condition control
- Dominant sows
- No feed intake data

Stanchions

- No body condition control
- Dominant sows
- No feed intake data

Tunnel

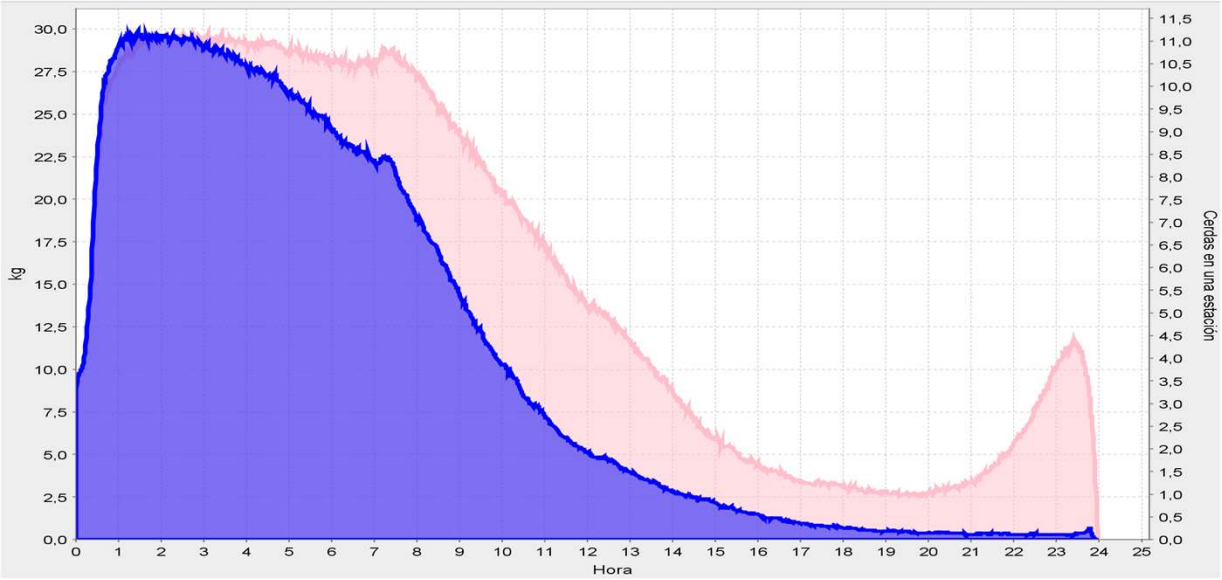
- One feeder per 50-90 sows
- Quite expensive for smaller groups
- ***It is a competitive system***
- Need of training (up to 5 % don’t learn)
- Electronic and pneumatics not always adapted to farm environment

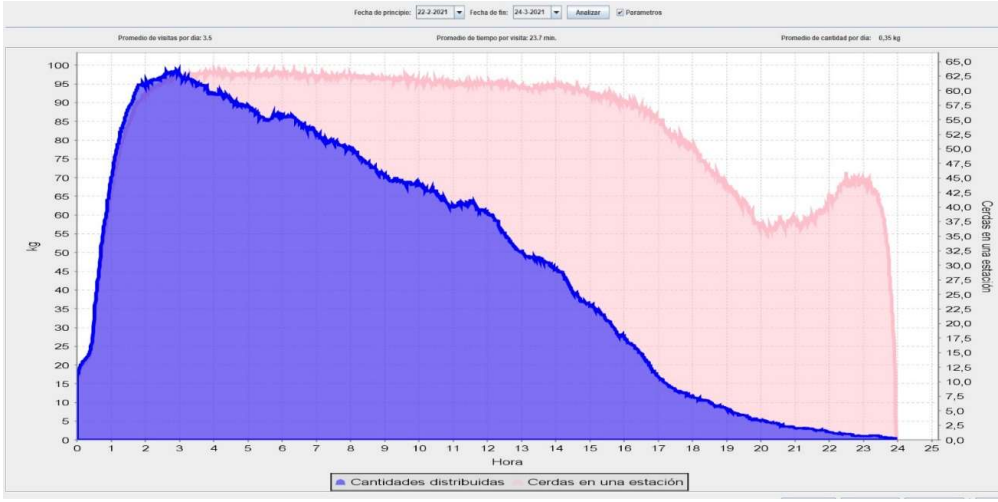
Example of sub-optimal digitalisation / sustainability

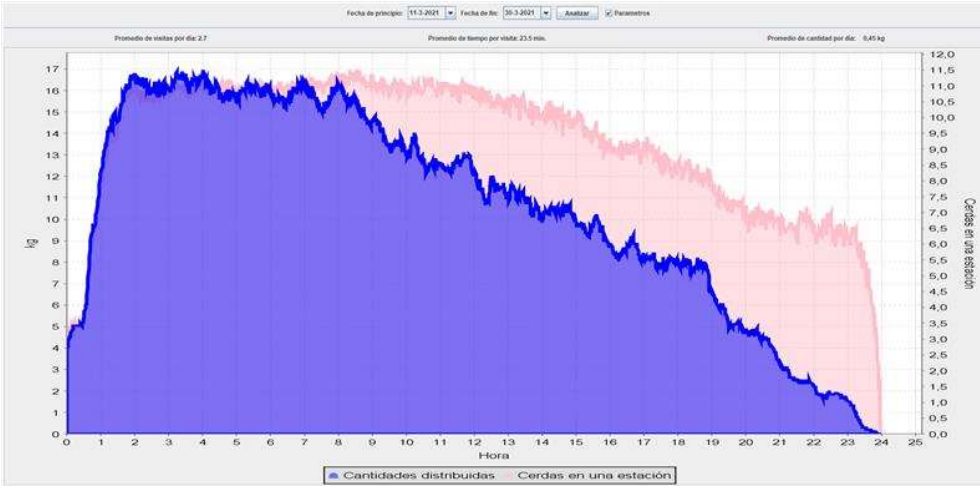
- Competitive system (70 in a row for feeding!)
- Higher costs
- Feed intake data
- Decreasing presence in the market

Good digital tools (ESF) can be applied in every type of farm.
Technology never should be a barrier.

How a gestating sow in groups eats when she can choose? (new ESF Systems)







CEP, 2022

Sows don't have 'breakfast, lunch and dinner'

Lactation, the phase with highest room for improvement

- Litter growth +2.5 Kg / d regularly (IFIP 2017). Over 100 kg of litter weaned.
- Required high intake of nutrients of excellent quality
- **Feeding Management** must be excellent for top performance
- We need knowledge and better tools

Protein

Lys

Ca y P

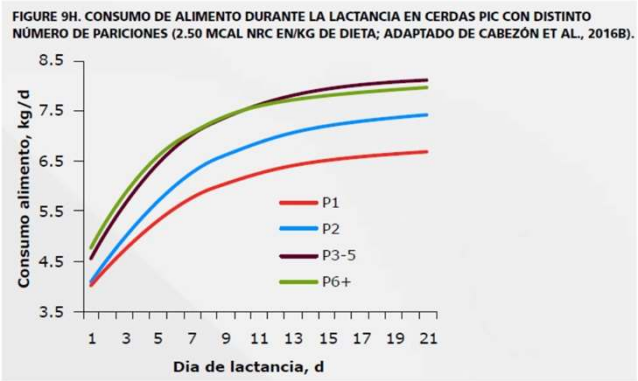
Microminerals

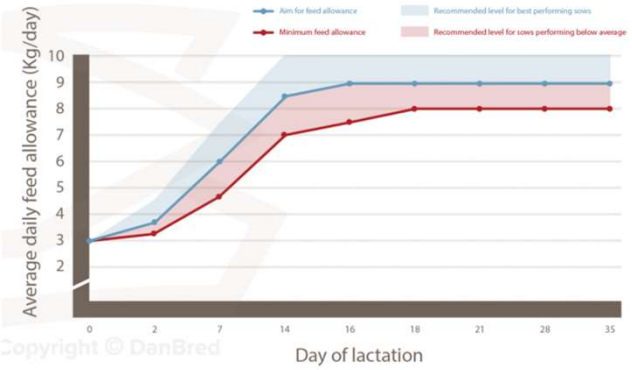
Vitamins

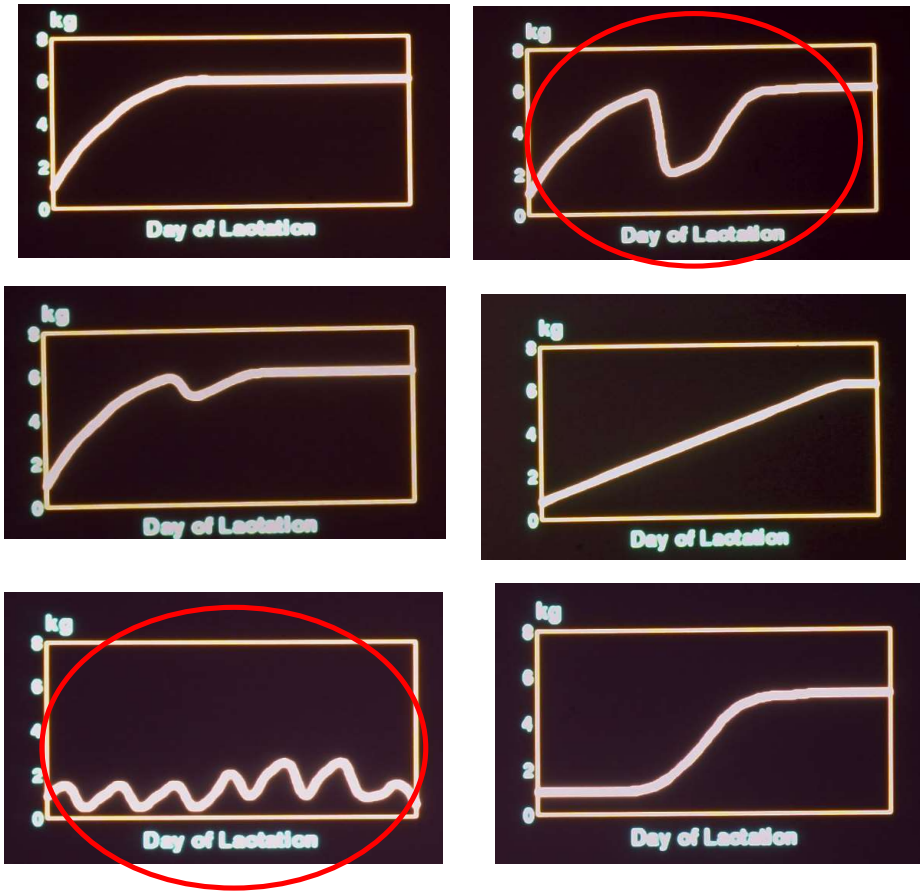
Energy

+ 2.5 Kg / litter / day

Does intake in lactation matter? what about the pattern?





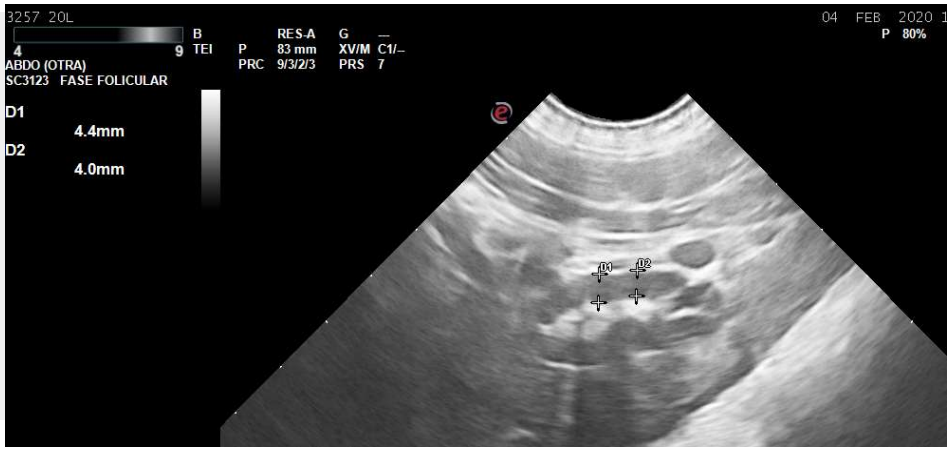


- Six patterns were described.
- Steep drop and irregular intake pose a risk to subsequent performance.
- More sensitive primiparas

Low repeatability: 12%.

Koketsu et al., JAS, 1996
Usui et al., Kanto ASJ, 2014

A good intake with a good pattern generates more and larger follicles (Quesnel, 2000)



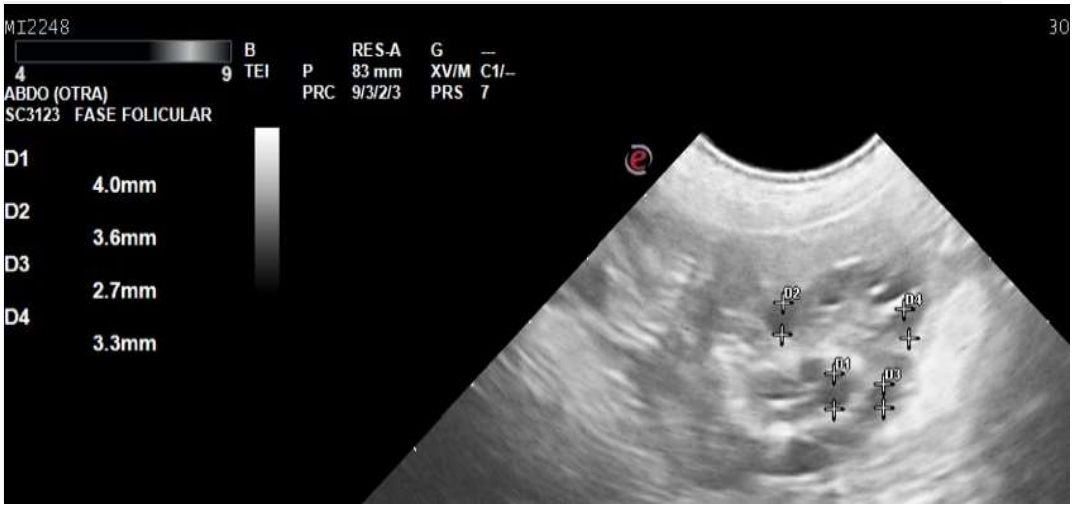
good

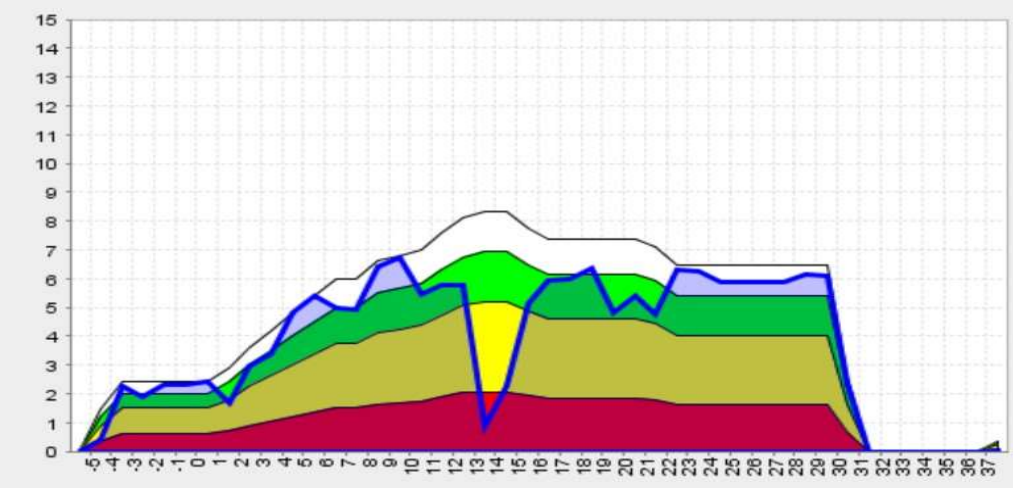
Imágenes A. Vela, Thinkingpig

3 patterns with different consequences

MMA

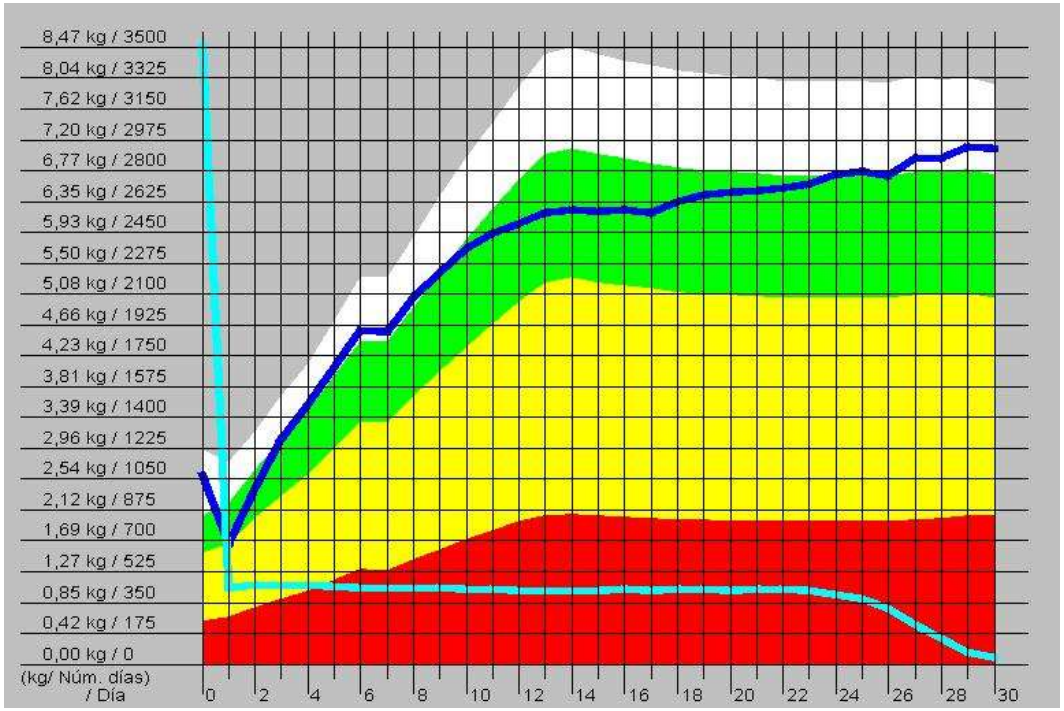
Reaction to vaccination

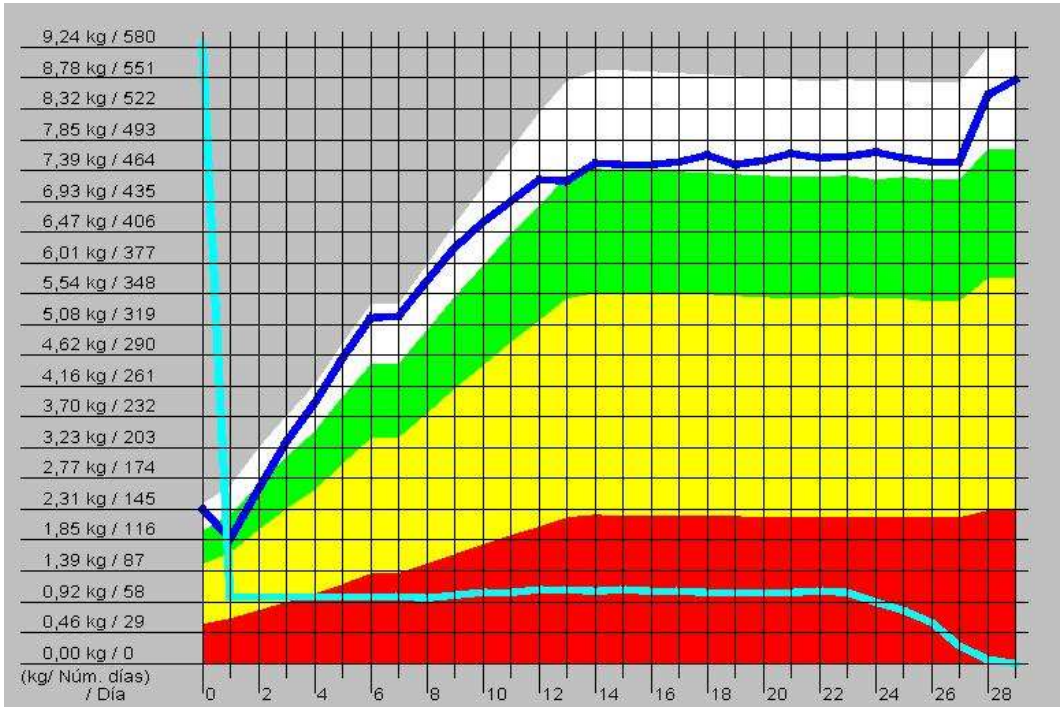




NEW CONCEPT: Lactation feed efficiency

(Topigs TN 70 vs DNA. P1 both).

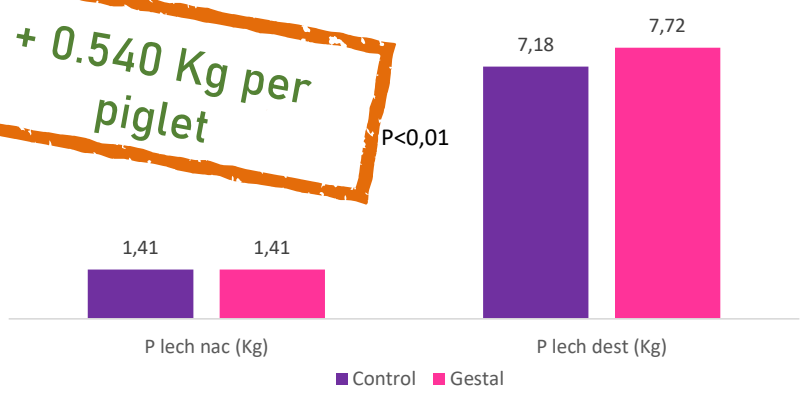




Summary of 36 field trials

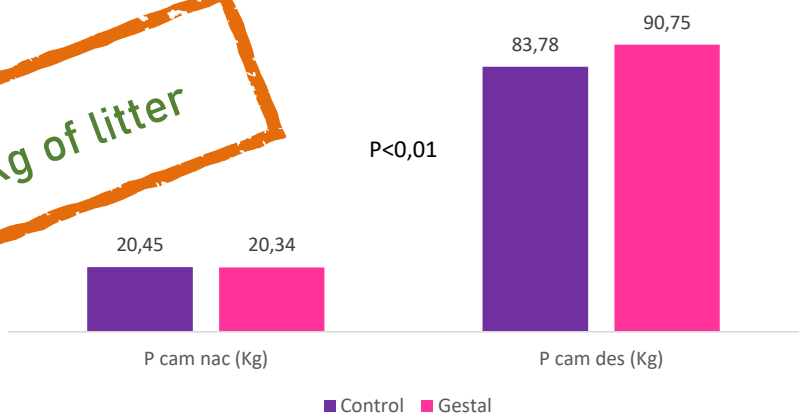
Peso medio del lechón al nacimiento y al destete

+ 0.540 Kg per piglet



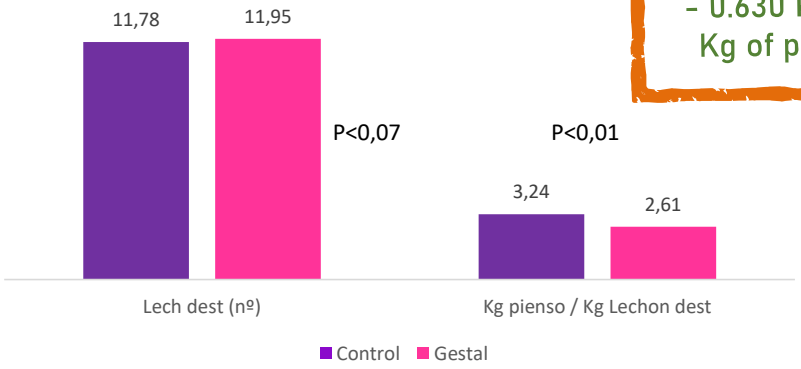
Peso medio de la camada al nacimiento y al destete

+ 7 Kg of litter



Lechones destetados / cerda y
Kg de pienso / Kg de lechón producido

- 0.630 Kg of feed per Kg of piglet weaned



A heavier piglet is very important at weaning

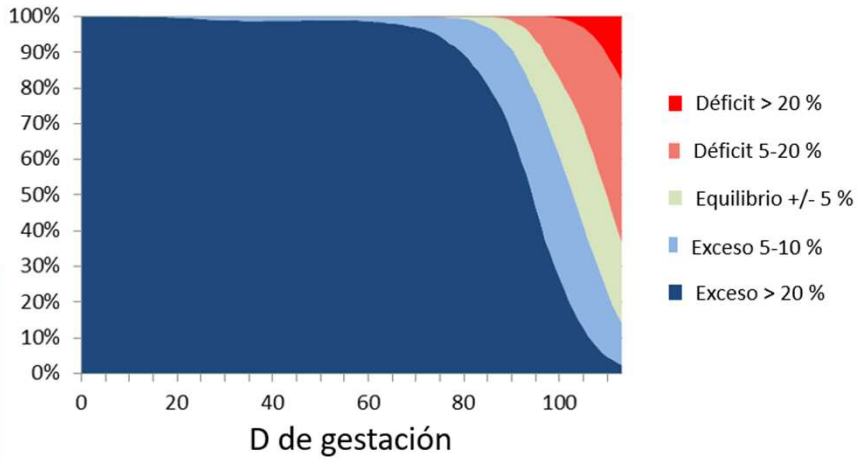
Literature describes it very well:

1. Higher ADG in nursery 5-10 %
2. Better FCR 1-5 %
3. Lower mortality 20-60 %
4. Less days to slaughter
5. Even more without ZnO!

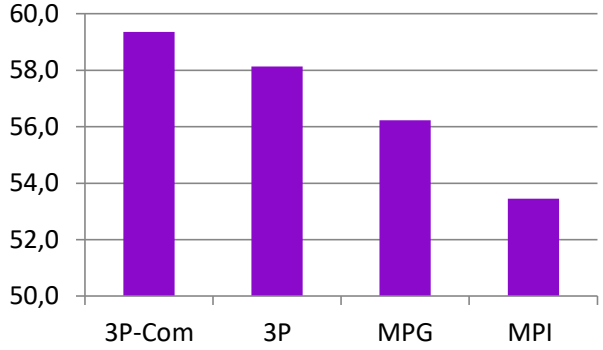
Pictures: Centro de Experimentación Porcino

Precision livestock feeding

- Topic that look for feeding tha animals based on its age and productive phase.
- **Usual diets are formulated with an excess of nutrients which leads to nutrients waste, higher cost and environmental pollution.**
- The working principles are described almost three decades ago, but were impossible to apply in practise
- Its proper application means (Pomar, 2019):
  - ***Decrease of feed cost (8-10%)***
  - ***Decrease of N and P intake (25%) and its excretion (40%)***
  - ***Green house gases emmisions (6%)***
- **Tailor made to sex (inmunocastration), breed, season or health status**



Feed cost (€/pig)

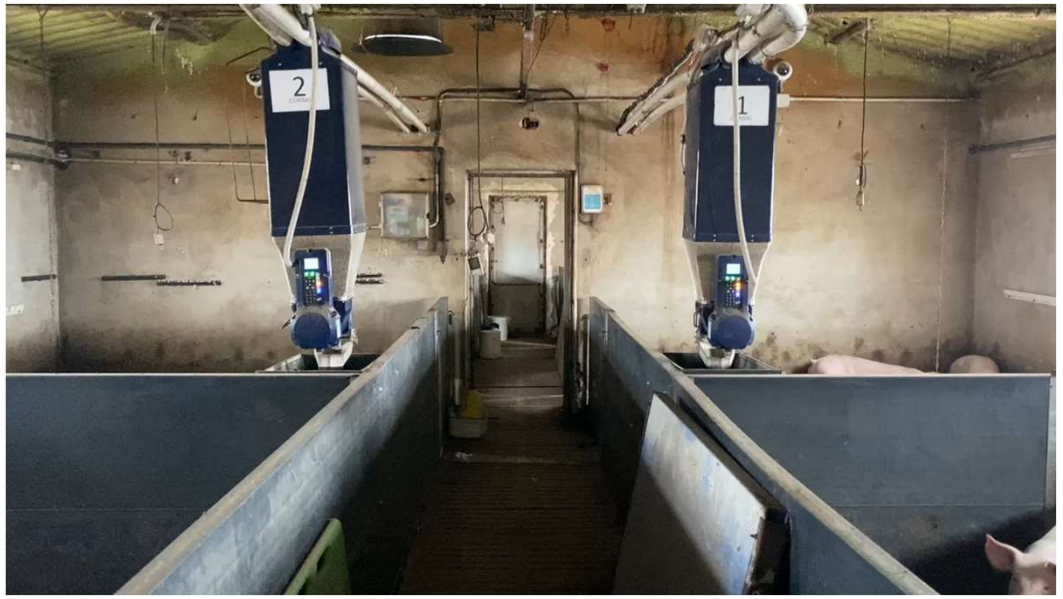


(P<0.01)

3-fases (pienso com.)	(3P-Com)
3-fases en grupo	(3P)
Multifase por corral	(MPG)
Multifase individual	(MPI)

Precision feeding (mixing feeds every day).

Savings in the cost of production 1.5-6.0 € / pig



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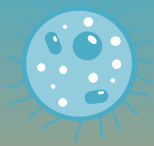
Health an antibiotics consumption

○●○



Digital biosecurity

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Production and health improvements over the last decades

	1980	2010	2025
PSY	15	25	35?
FSY	2,0	2,4	2,4?
Weaning age	30	21-28	21-28?
ADG finishers(g/d)	550	750	950?
FCR finishers	3,2	2,8	2,2?
% Pneumonia abattoir	20-25	20-25	?
% Pleuritis abattoir	15-20	15-20	?

Overall improvement :

- Reproduction +++
- Fattening ++
- Health + o ≅

Meyns et al., Vet J 2011

HealthyLivestock

健康畜禽

Tackling antimicrobial resistance (AMR)
by increasing the health and welfare of pigs and poultry and thereby reducing the need to use antimicrobials.

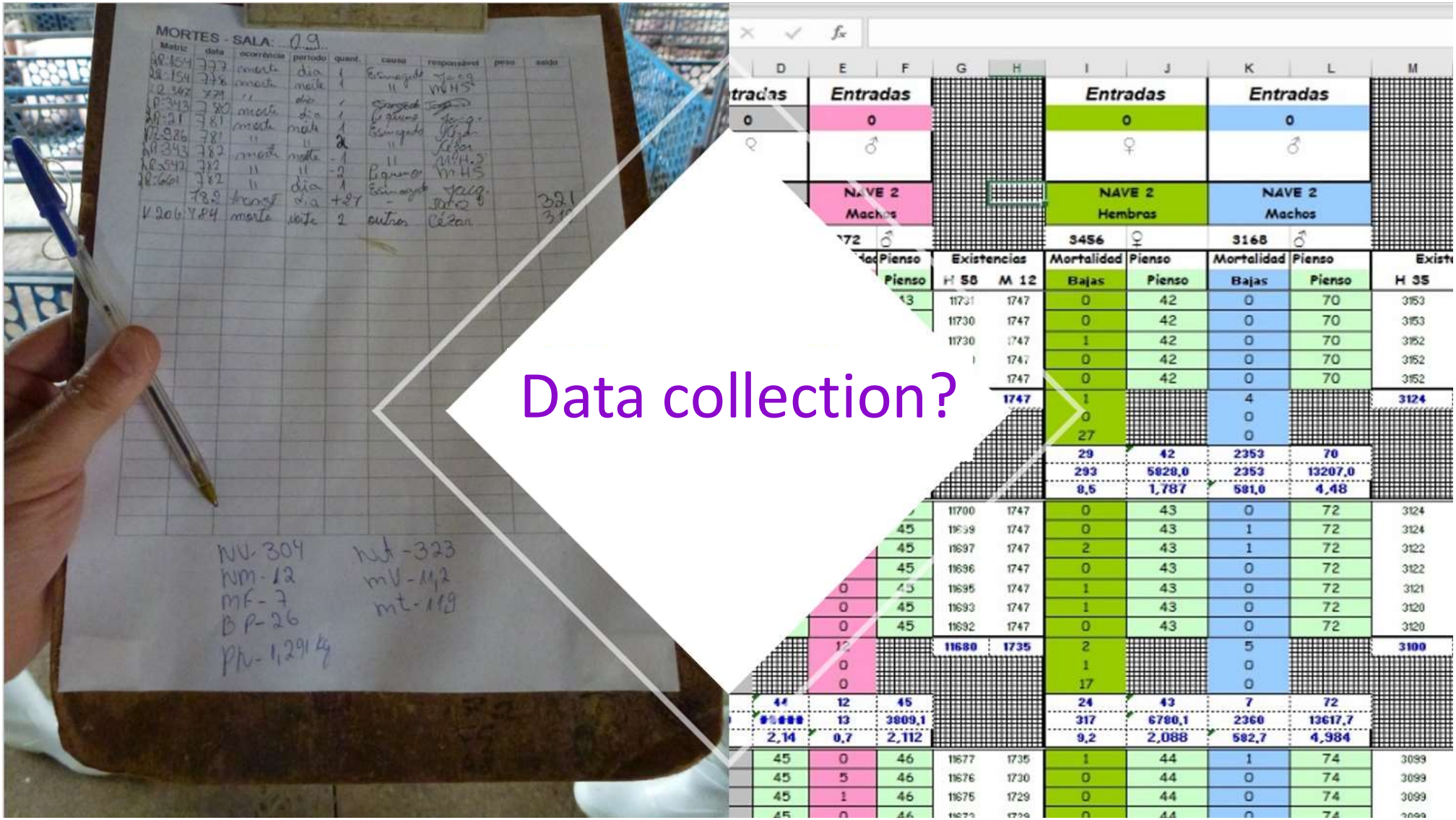
Animal health control has traditionally had room for improvement.

- **Mortality** is the key index, usually recorded at the end of each phase (nursery and fattening).
- **Prevalence and incidence**, real or almost real-time **are not used**
- Deaths are rarely typified by the type of disease, age at culling or both simultaneously.
- Therefore, **monitoring is very difficult, preventing rapid reaction to alerts/outbreaks.**
- No images, videos or lab results are kept in an orderly manner

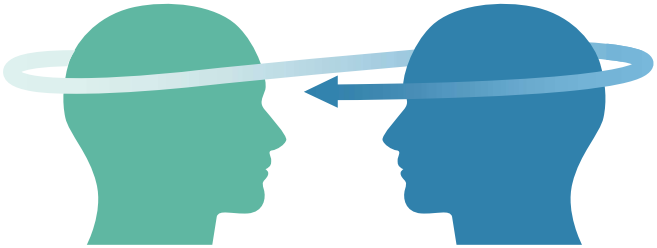
…and also, antibiotics use

- Until now, **little to no control** (just as an expense for cost control).
- **Mass registration** recently for legal reasons (whole farm purchase).
- **No quality registration**, including route of administration, dosage, active ingredient or disease to be treated.
- **No aggregation** of batches, barns or farms.
- **Use not related to prevalence and incidence** of diseases.
- Data is sent from farm, but **little information is sent back** to farm regularly.

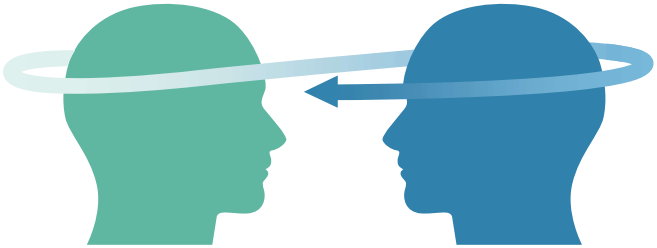
As vets, it is tough to control health without knowing the prevalence & incidence of disease and the use of antibiotics on farms

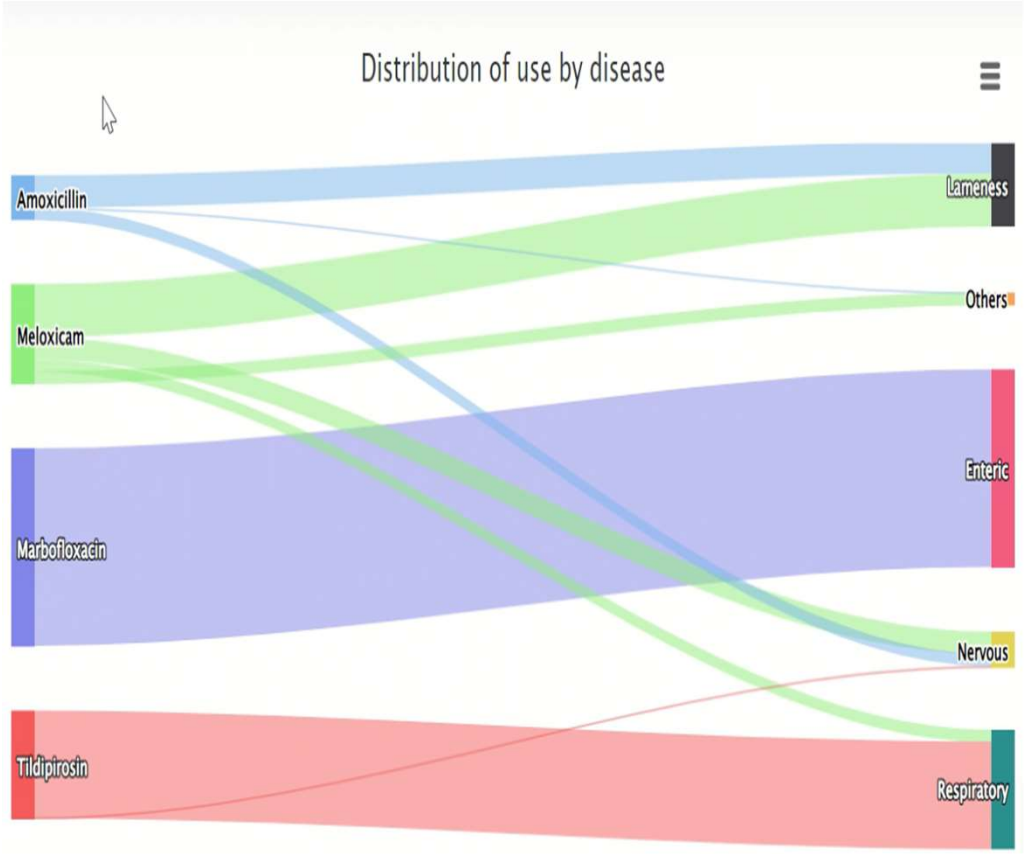

MORTES - SALA: 09
Matriz | data | ocorrência | período | quant. | causa | responsável | peso | saldo
NV-304
NM-12
MF-7
BP-26
PN-1,2914
NV-323
MV-11,2
MT-119
Entradas
Entradas
Entradas
Entradas
NAVE 2
Machos
NAVE 2
Hembras
NAVE 2
Machos
3456
3168
Existencias
Mortalidad
Pienso
Mortalidad
Pienso
H 58
M 12
Bajas
Pienso
Bajas
Pienso
H 35
Data collection?

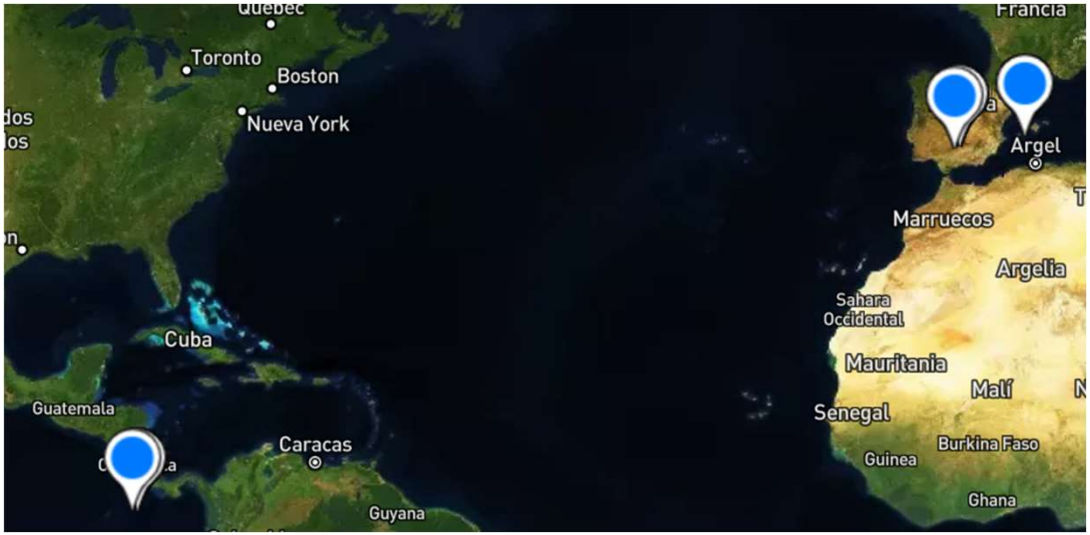
Digital tools support health and performance, decrease antibiotics use and promote therefore sustainability of the industry.
And involving easily staff in the routinely use



Digital surveillance supports health and performance, decreases antibiotics use and promotes, therefore, the sustainability of the industry

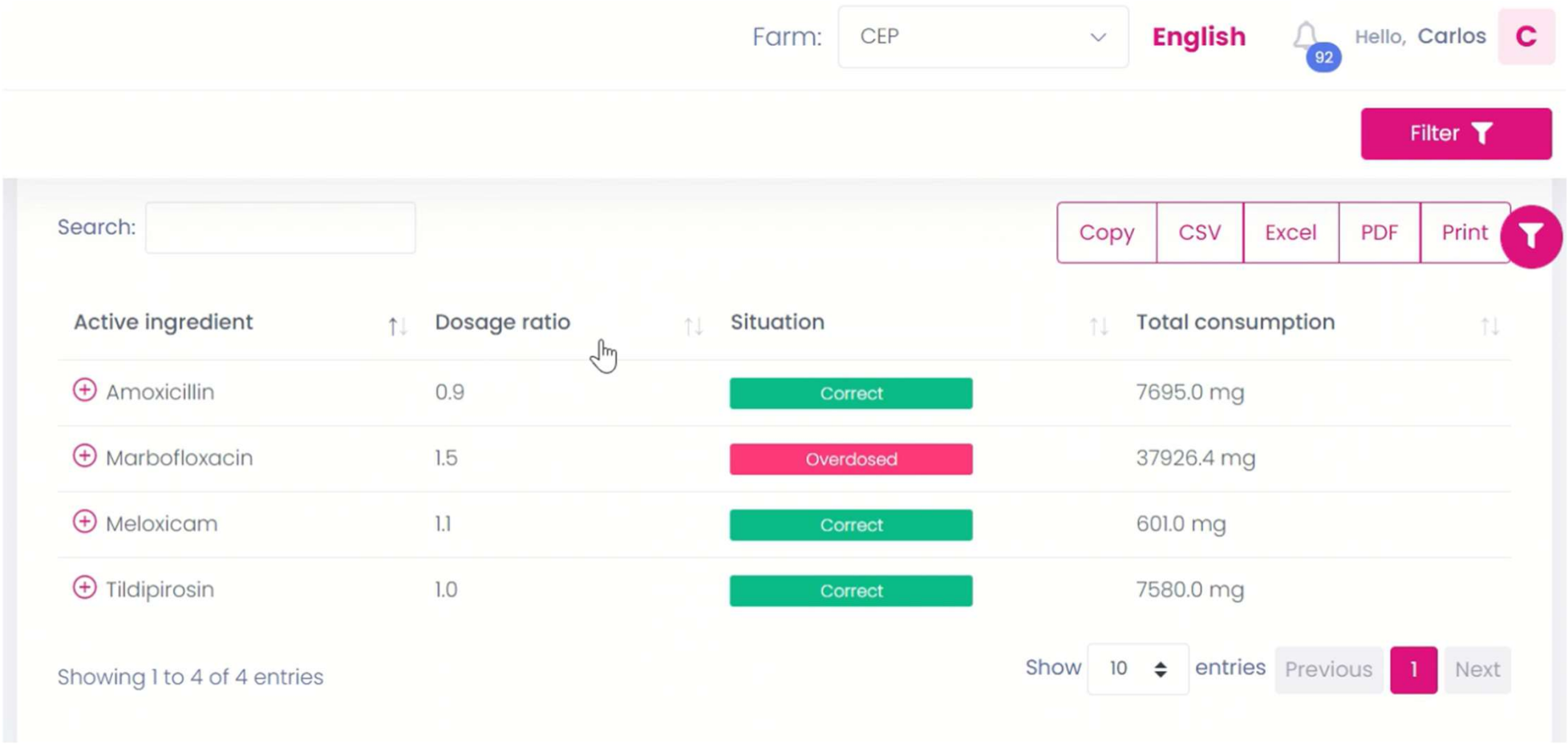




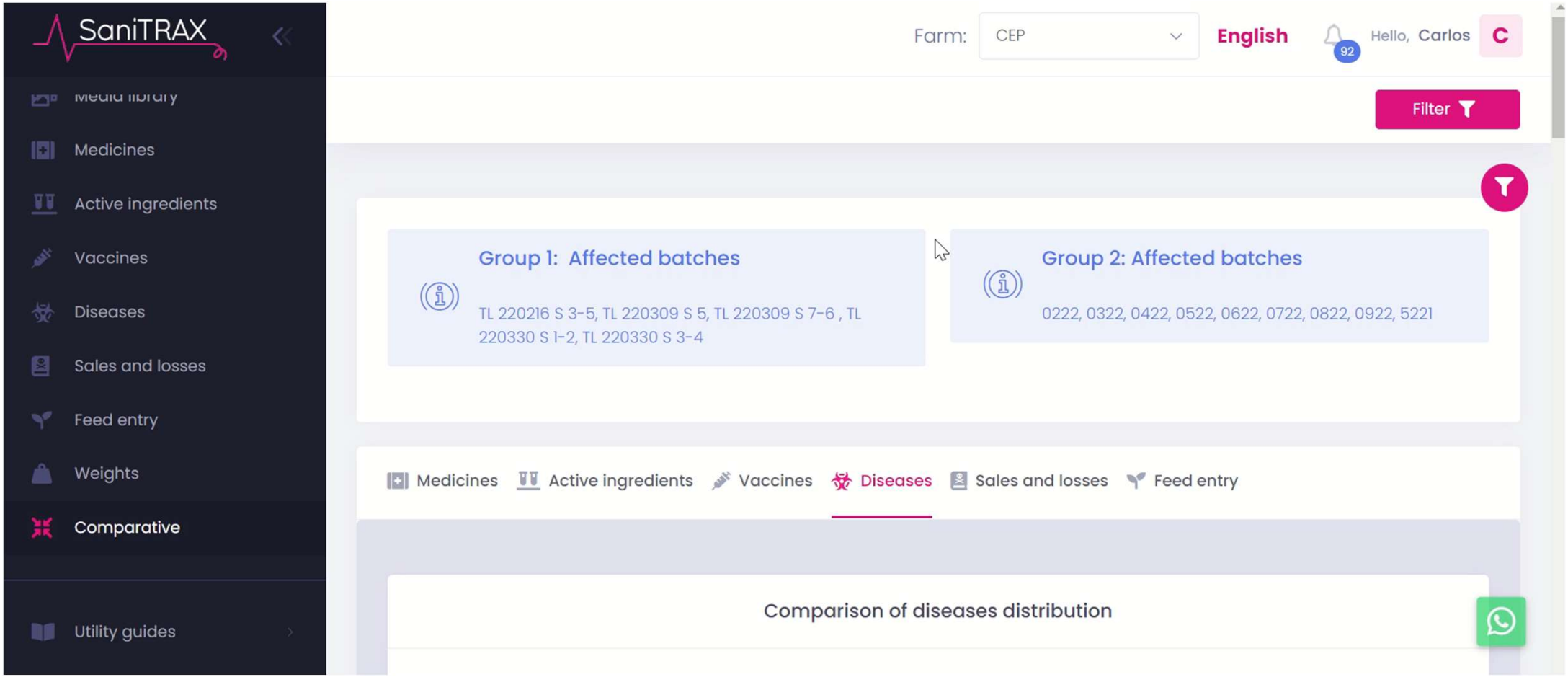


Prevaler time control

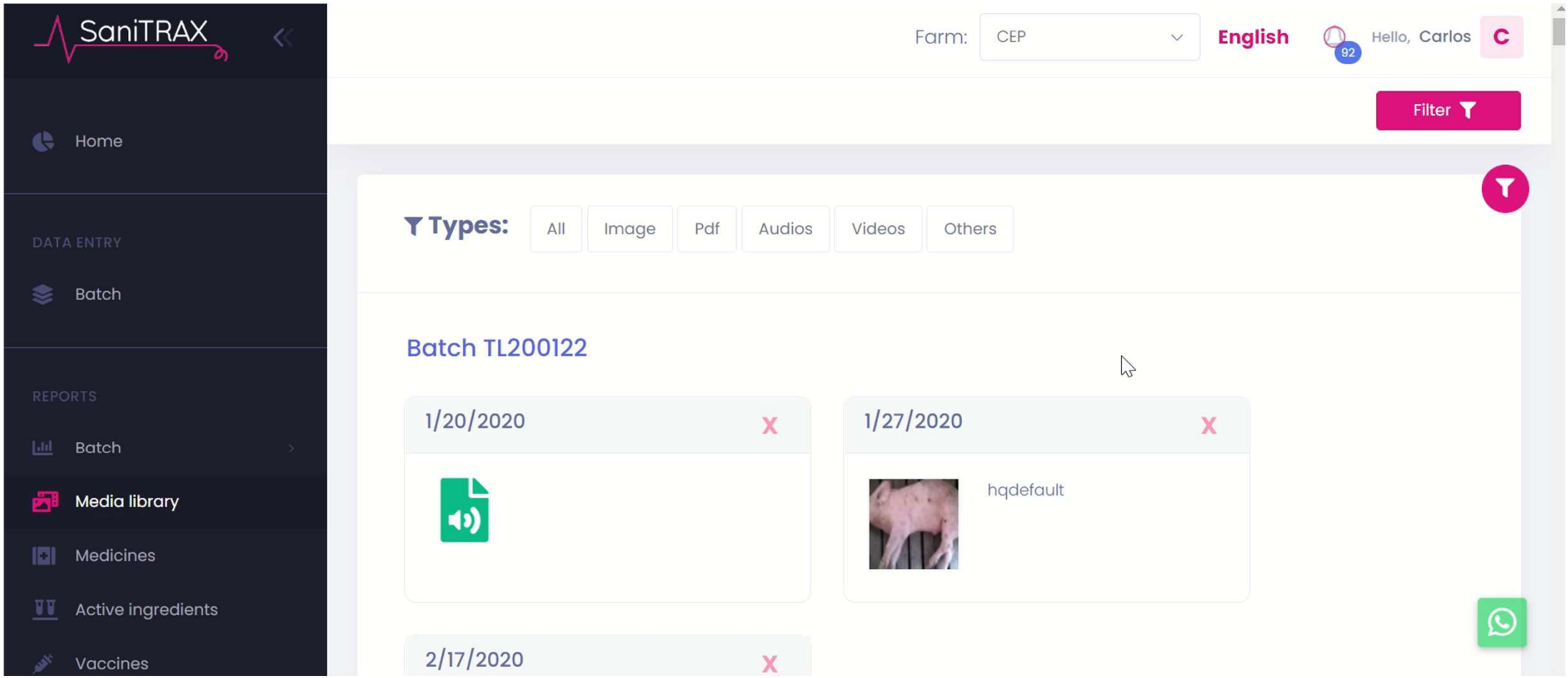
Antibiotics use, total consumption, per animal and per kg of animal entered



Comparisons; vaccines / feed additives

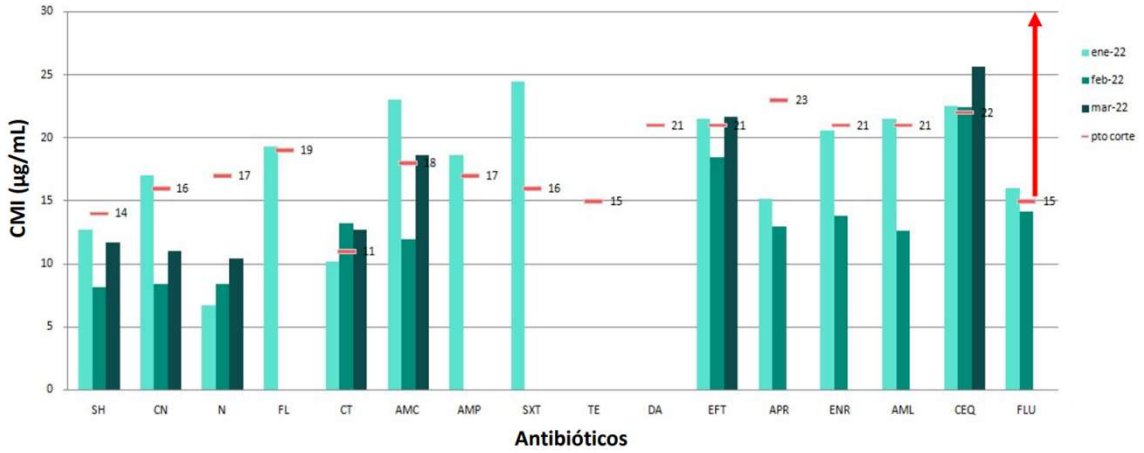


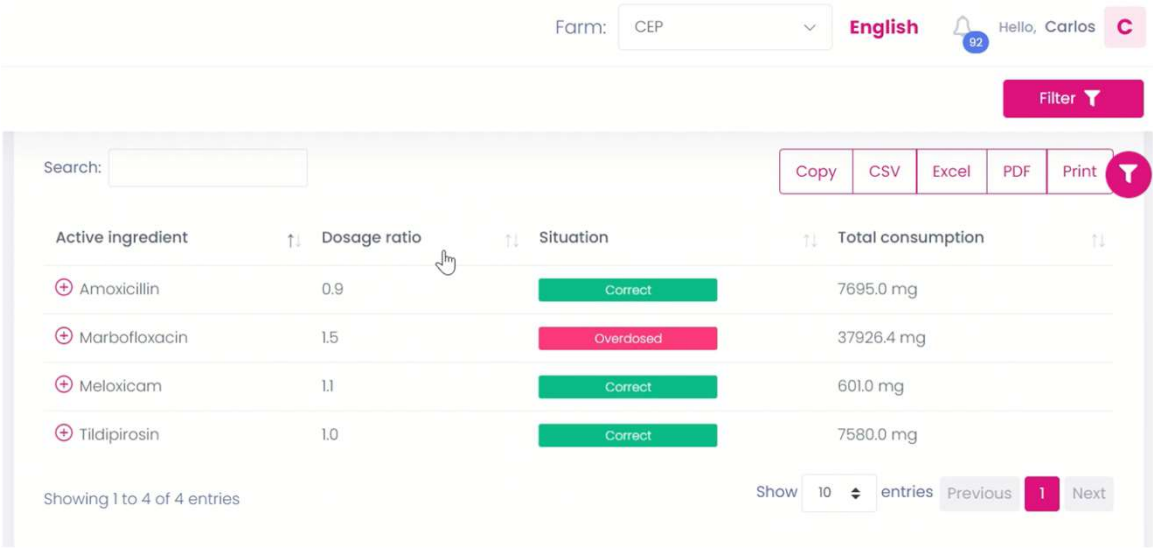
Multimedia library linked to each batch, barn, farm or company



Integration with lab results (MIC, PCR, etc.)

- Real-time health, production and antibiotic use monitoring
- Data collected quickly and seamlessly
- Add batches and farms
- Add photos and videos
  Generate alerts and task reminders
- Integration with lab data





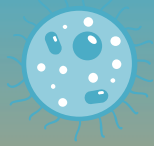
Three areas to start working

Electronic and precision feeding

●○○

Health an antibiotics consumption

○●○



Digital biosecurity

○○●

Why Biosecurity?

Most concerning topic globally

Global Health Alerts

Economic looses

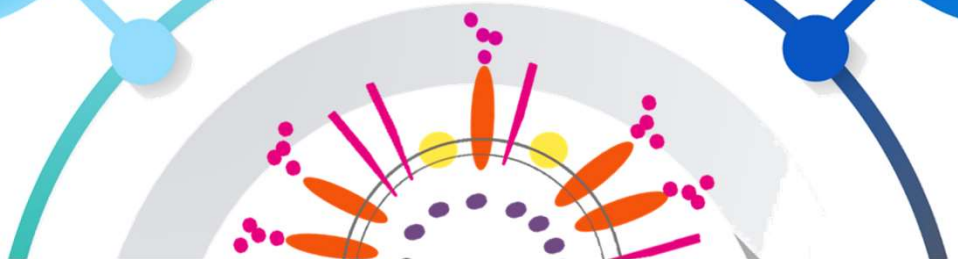
PRRS in USA

+600 mill $/year

ASF

PRAM

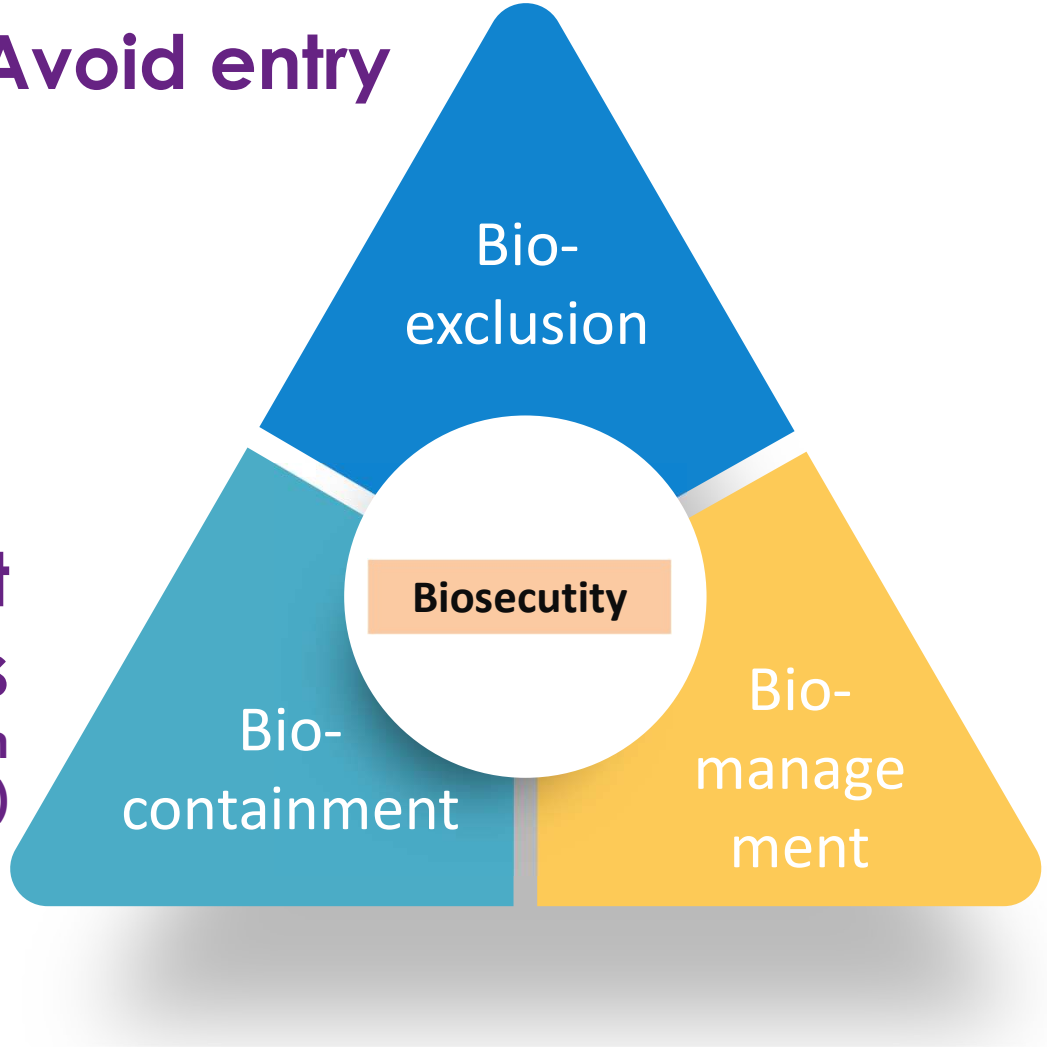
Reduction of antibiotic use



pigChamp pro europa

The three components of biosecurity

Avoid entry

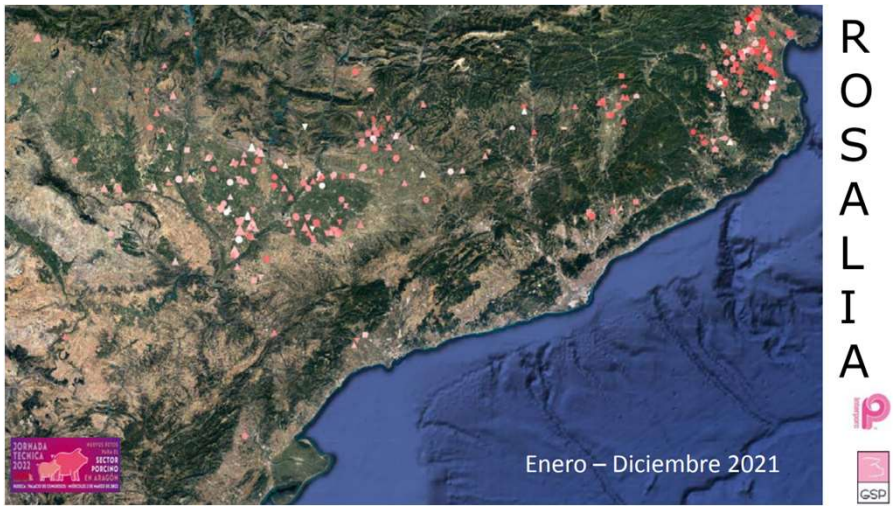


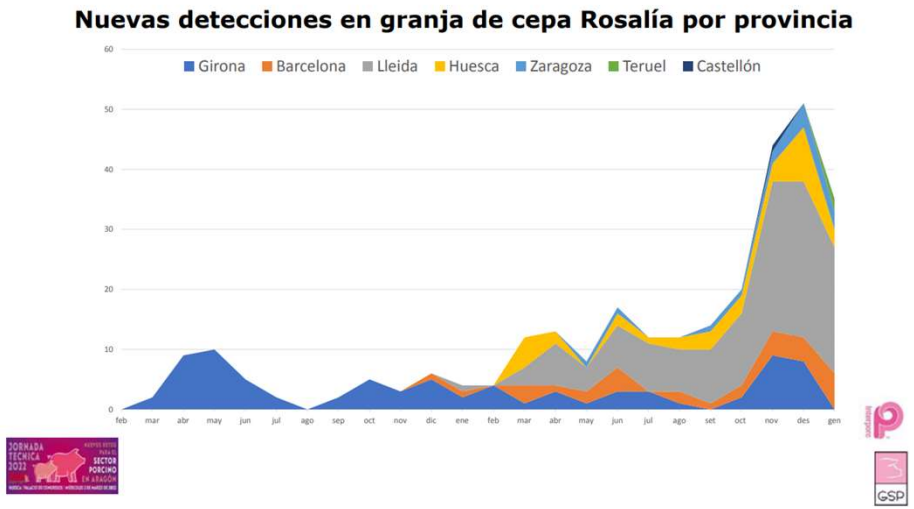
Do not infect other farms
(transportation biosecurity)

Avoid spreading

We have a high risk situation

Do not forget dysentery, actinobacilosis, mycoplasmosis, ileitis, influenza, salmonella, colibacilosis, o PED among others.





Research finds 94% of disease outbreaks attributed to 4 risk factors

- Local transmission, farm-to-farm proximity
- Pig movement, between farms
- Vehicles, pig movement between farms
- Vehicles, feed delivery

Biosecurity must consider also social and psychological aspects

- Perception of risk
- Knowledge of the disease and its consequences
- Medium-term maintenance and false sense of security
- We don't always do what we say or say what we do'.
- We don't have any objective metrics, at most surveys

ADA proposal;
Classical knowledge + digital tools

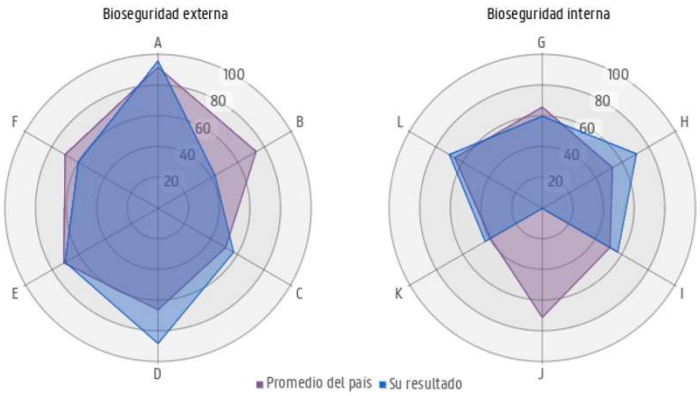
1 › Surveys

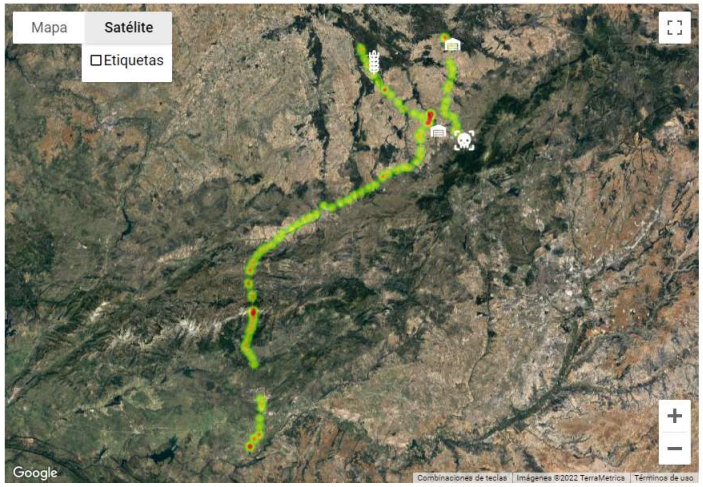
2› Audits

3 › Digital control

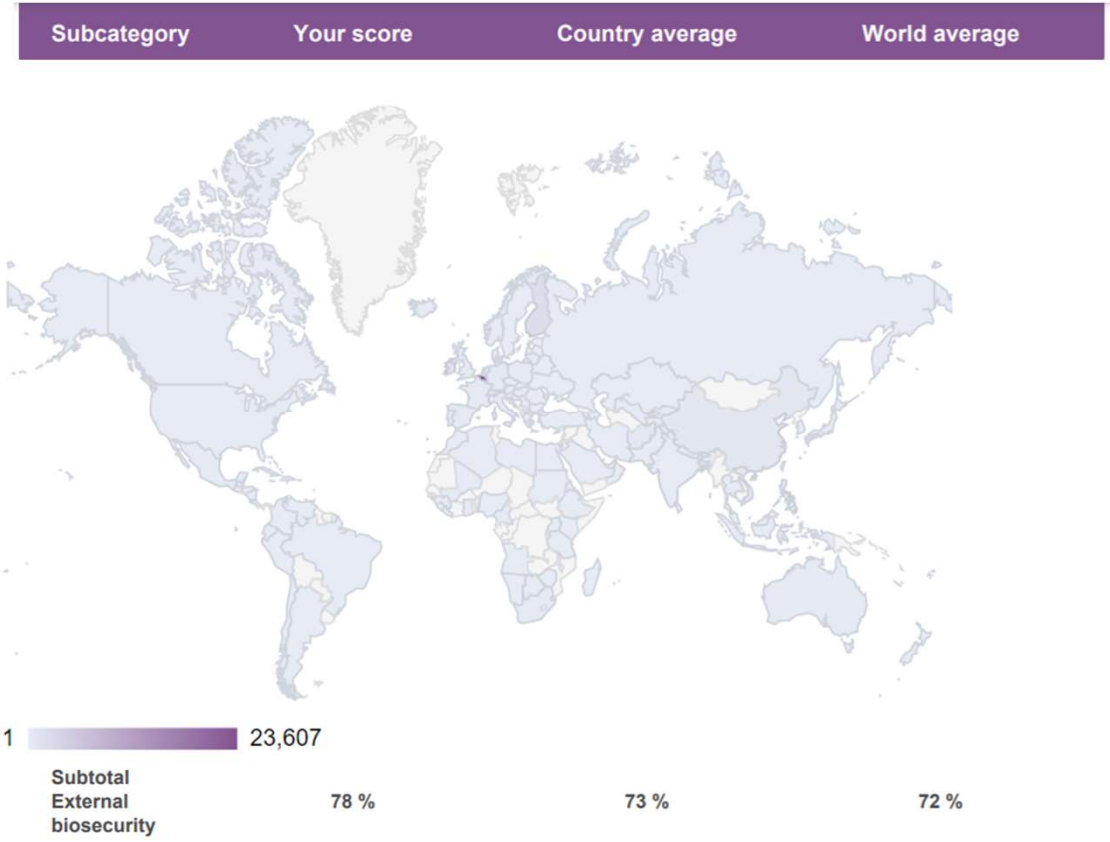
https://biocheck.ada-animaldata.com/

biocheck .ugent





Surveys and benchmarking



Worldwide usage of Biocheck.UGent

The Biocheck.UGent has already been used **47791** times to evaluate the biosecurity in farms worldwide.

→ Worldwide statistics

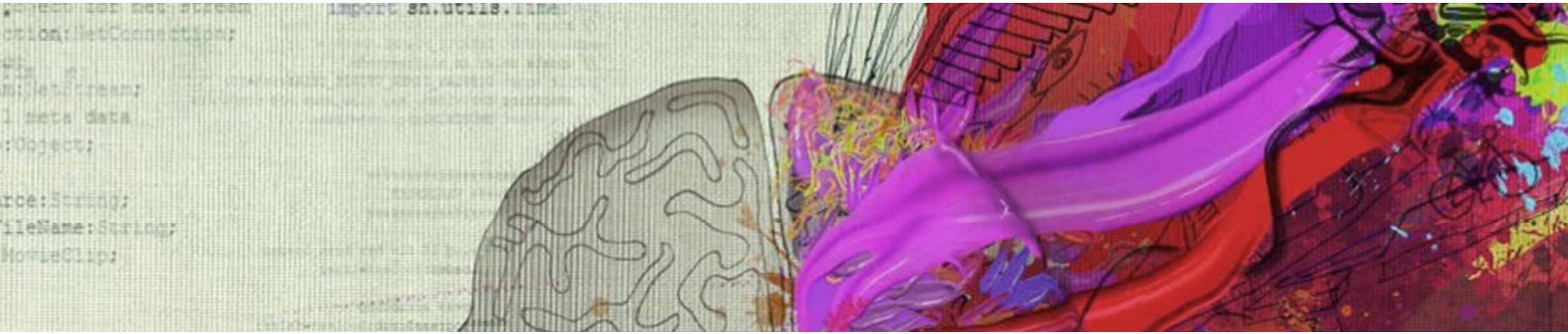
Farm audit on-site

Etapa 01 — Surveys

Etapa 02 — First analysis

Etapa 03 — Farm visit

Etapa 04 — Second analysis and final report

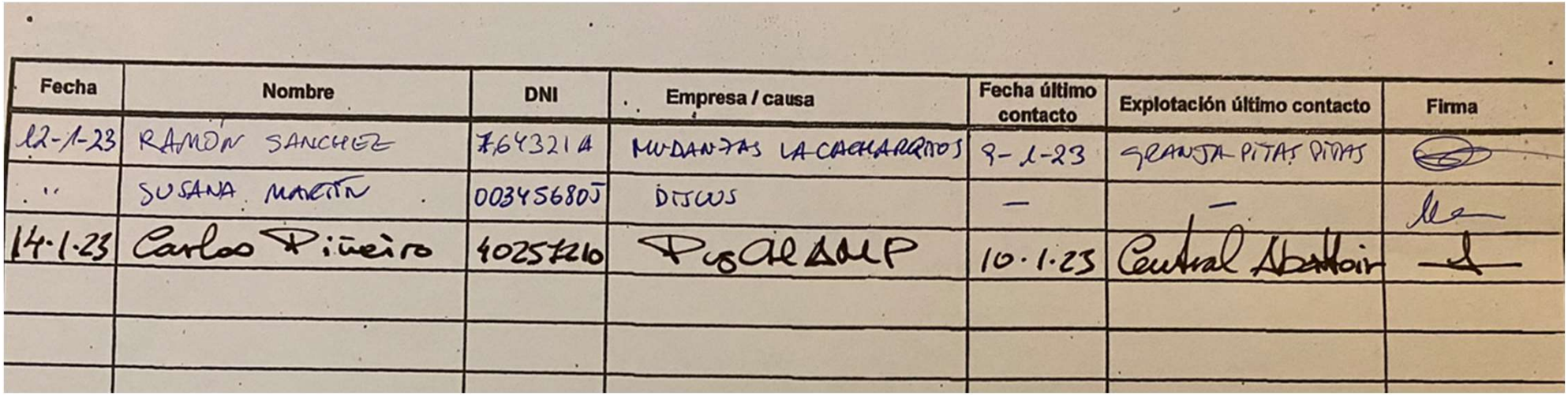


We must move from guessing to certainties

and that means:

Working protocol + BIOSECURITY DATA

Visitors' book; not very useful con prevent unauthorized visits and keep traceability



Fecha	Nombre	DNI	Empresa / causa	Fecha último contacto	Explotación último contacto	Firma
12-1-23	RAMÓN SANCHEZ	7643214	MUDANZAS LA CACHARRITOS	9-1-23	GRANJA PITAS PITAS	
"	SUSANA MARTIN	00345680J	DISCOS	—	—	
14-1-23	Carlos Piñeiro	40257216	Pos Al DAP	10-1-23	Central Abattoir	

External biosecurity control. How does it work?

1

Manual or GPS registration of trucks and visitors

2

The company parametrized the rules

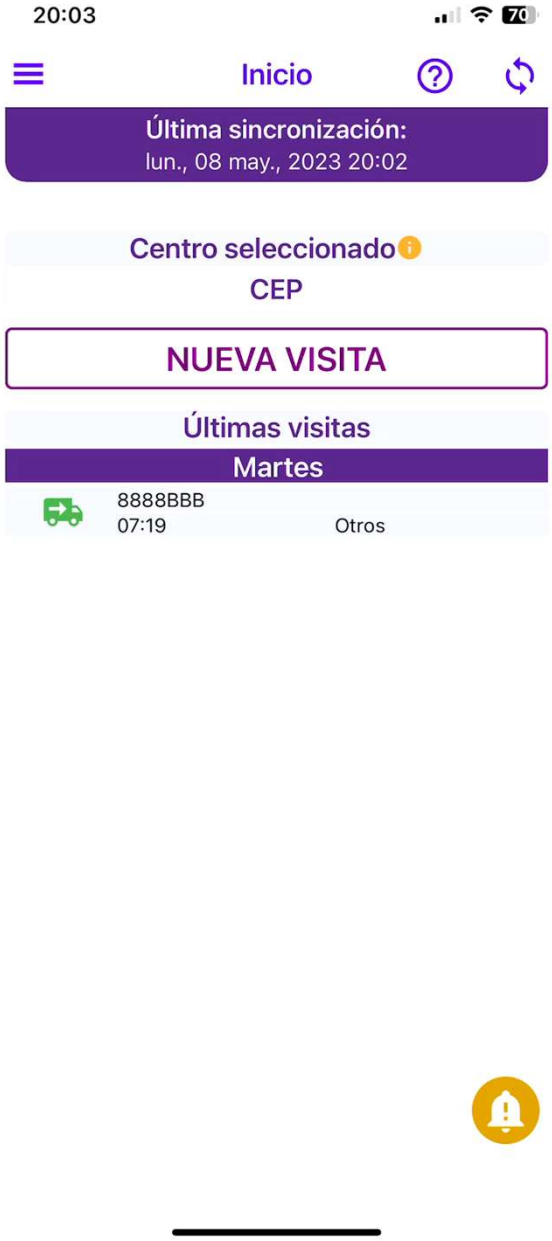
Origin center		Destination center	
Type	Status	Type	Status
Washing center		Farm	
Washing center		Artificial insemination centre	
Slaughterhouse	0 (Negative)	Farm	1 (Eradicating)
Slaughterhouse		Artificial insemination centre	
Slaughterhouse		Slaughterhouse	
Slaughterhouse	2 (Stable positive)	Slaughterhouse	2 (Stable positive)
Feed factory		Artificial insemination centre	

3

The system reacts allowing the visit or not and showing real-time information

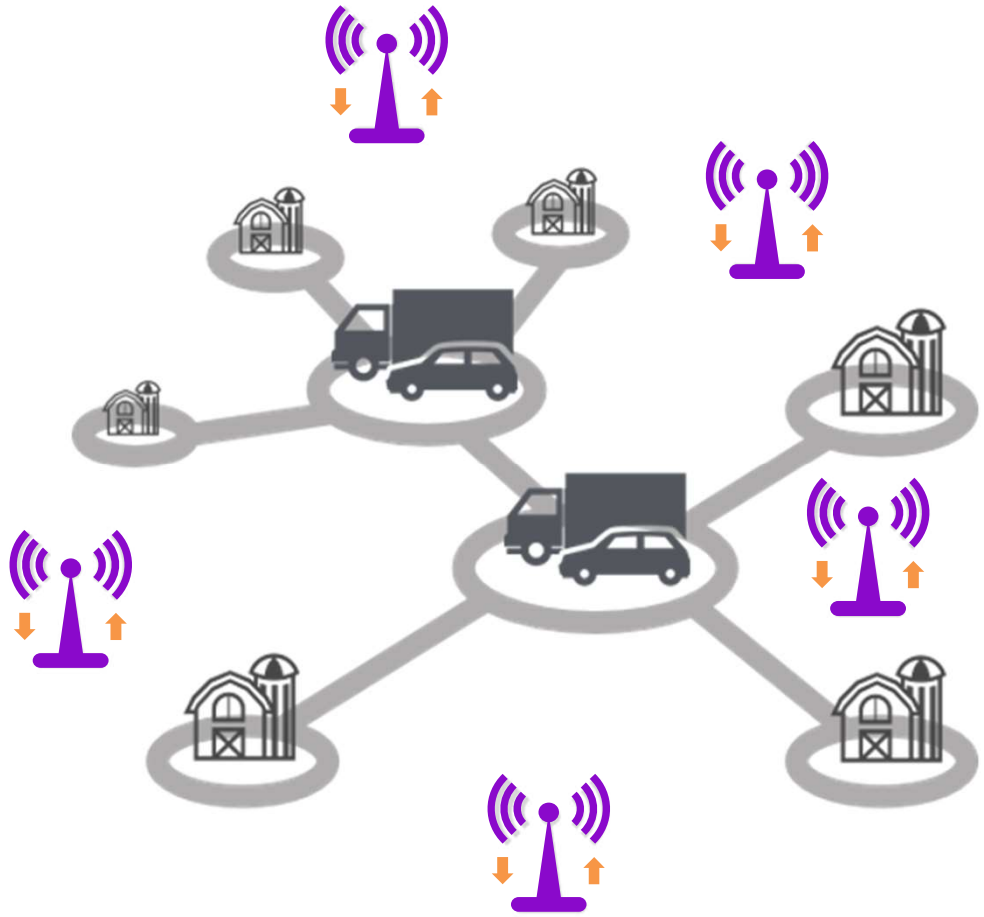
How does it work?

1- Entrada de datos via app en granja



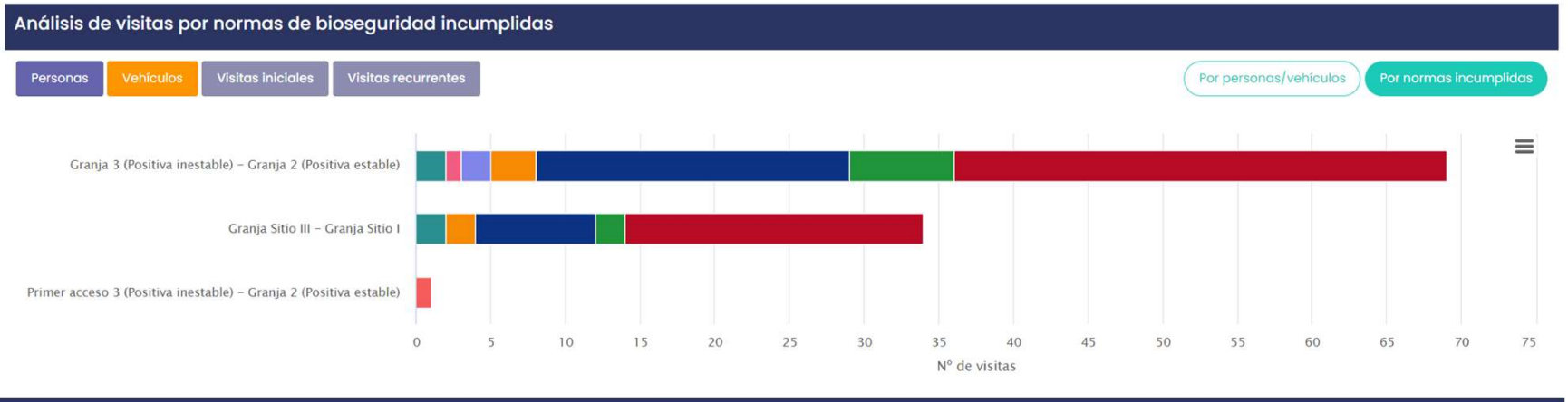
How does it work?

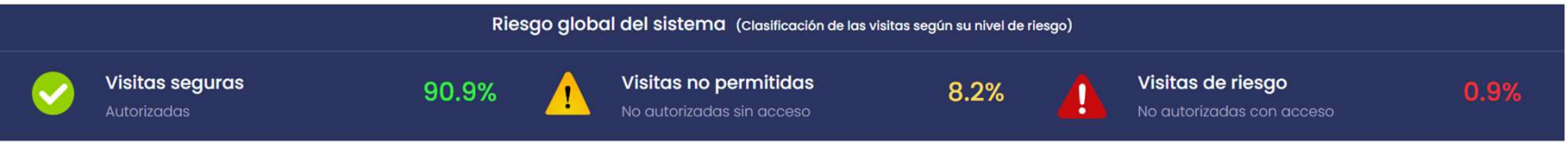
2- Entry form the GPS of the vehicles



ALERTS

Real-time prevention and control

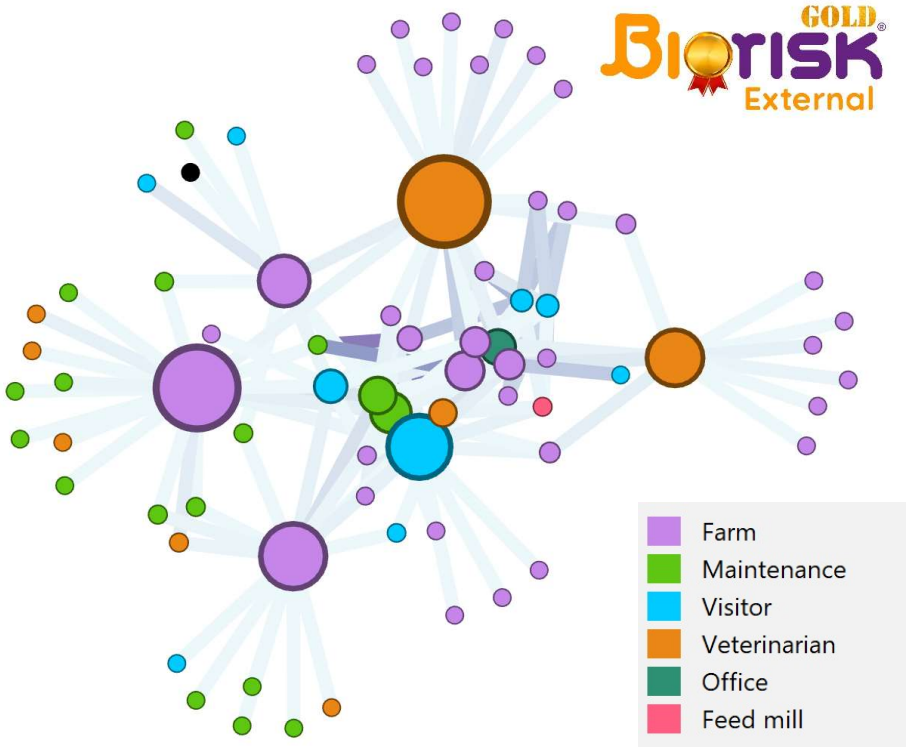


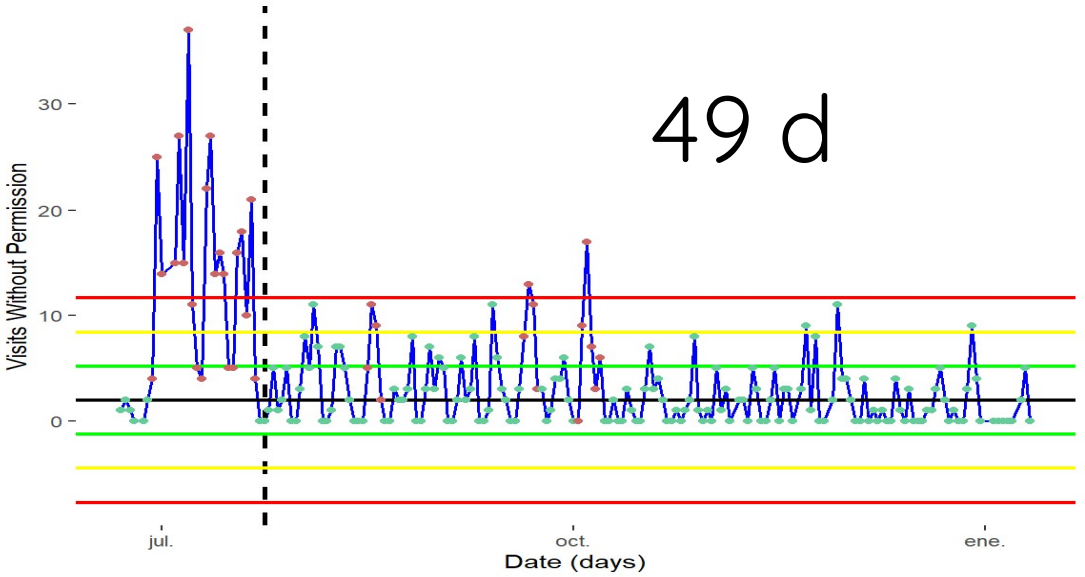


- Hundreds of non allowed visits stopped

¿Which are the superspreaders Farms today? And in the future?

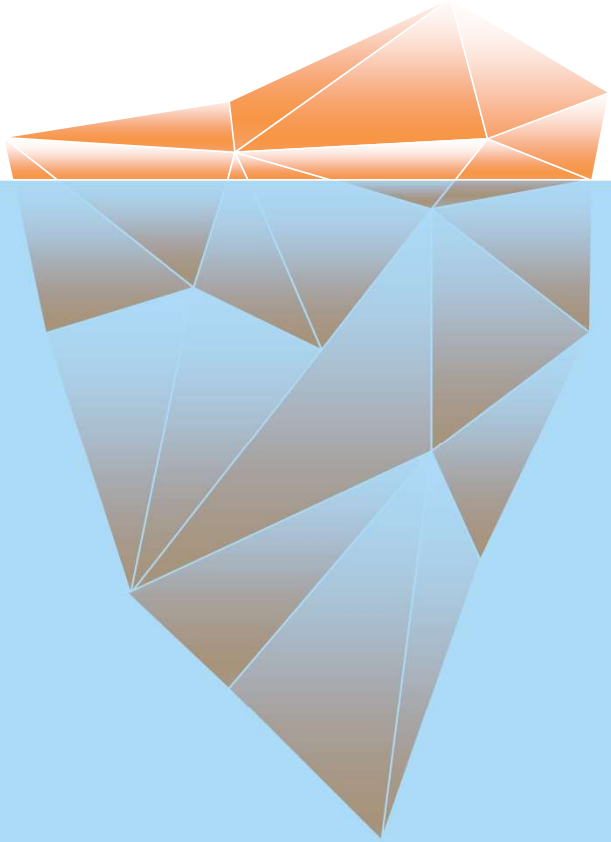
Not only alerts and monitoring;
Let's add epidemiology and data science





¿How long does it take to respect the rules in the company?

And finally, DATA SCIENCE

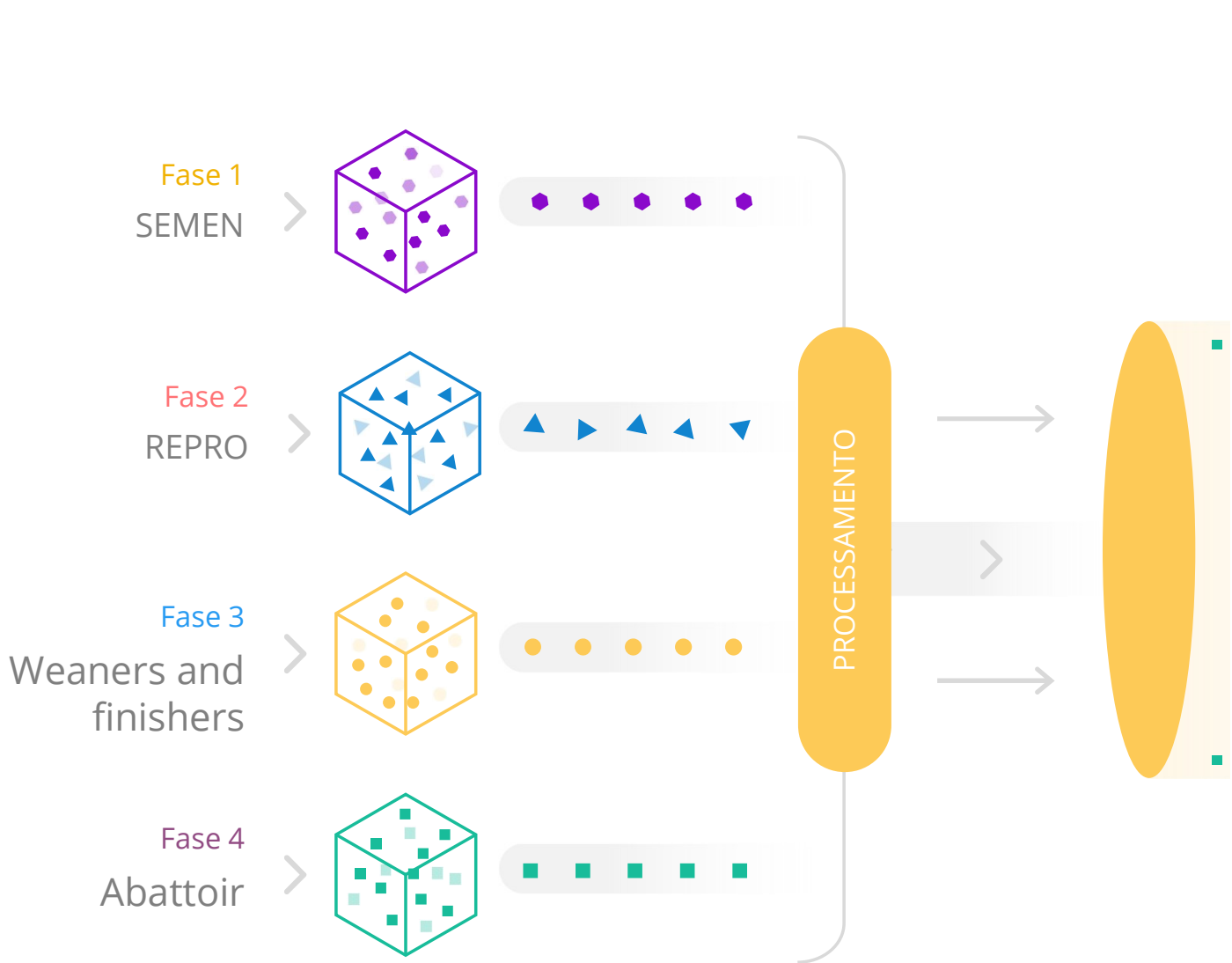


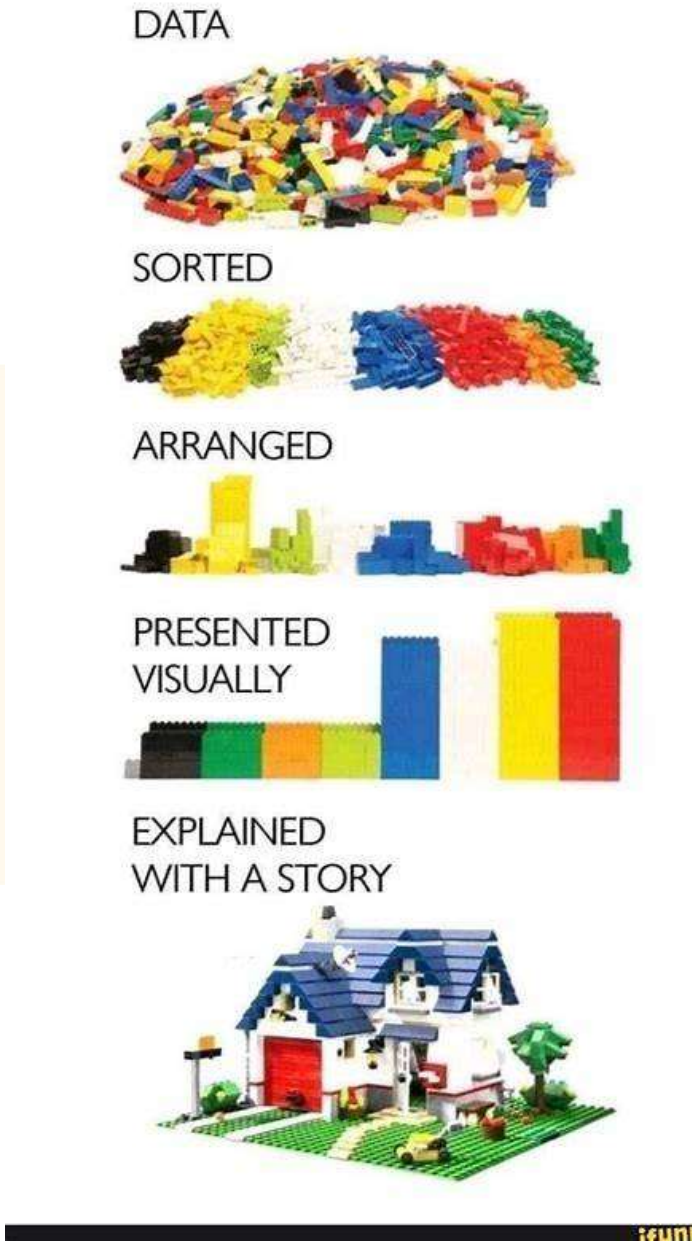
Lack of time

Non-adequate education

Lack of professionals

Awareness


Fase 1
SEMEN
Fase 2
REPRO
Fase 3
Weaners and finishers
Fase 4
Abattoir
PROCESSAMENTO


DATA
SORTED
ARRANGED
PRESENTED VISUALLY
EXPLAINED WITH A STORY

Let’s see some practical examples

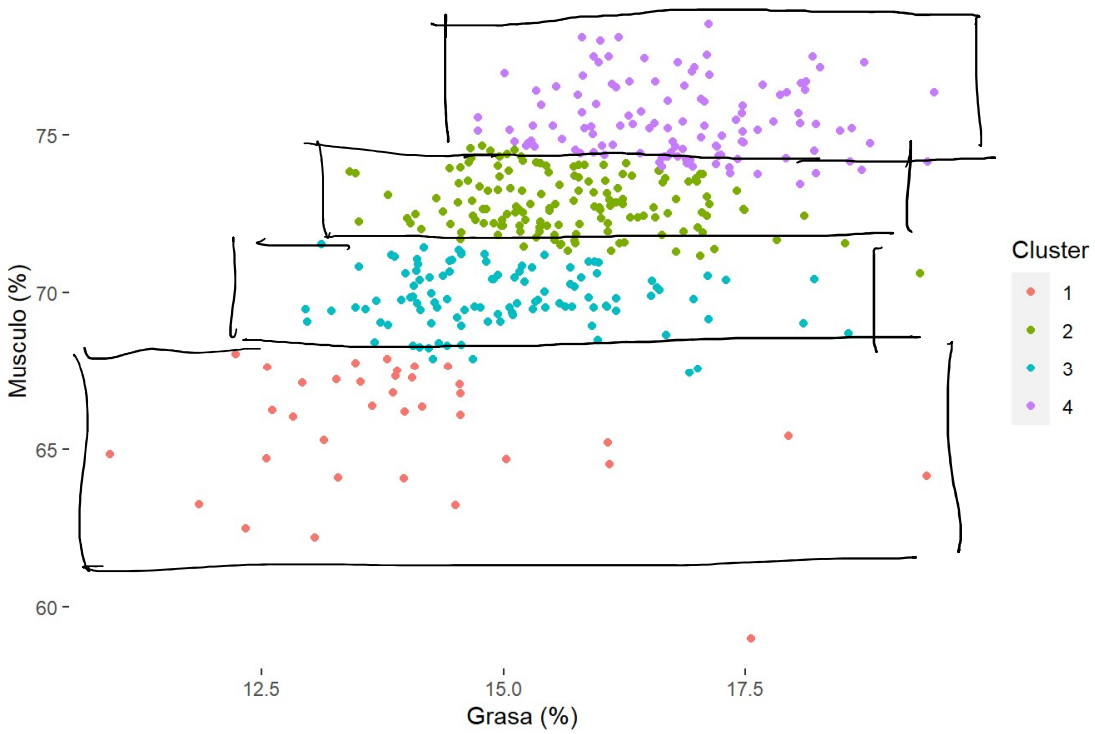
ALWAYS IS ABOUT OF ANSWERING QUESTIONS

THE ABATTOIR IS RECEVING PIGS VERY HETEROGENEUS

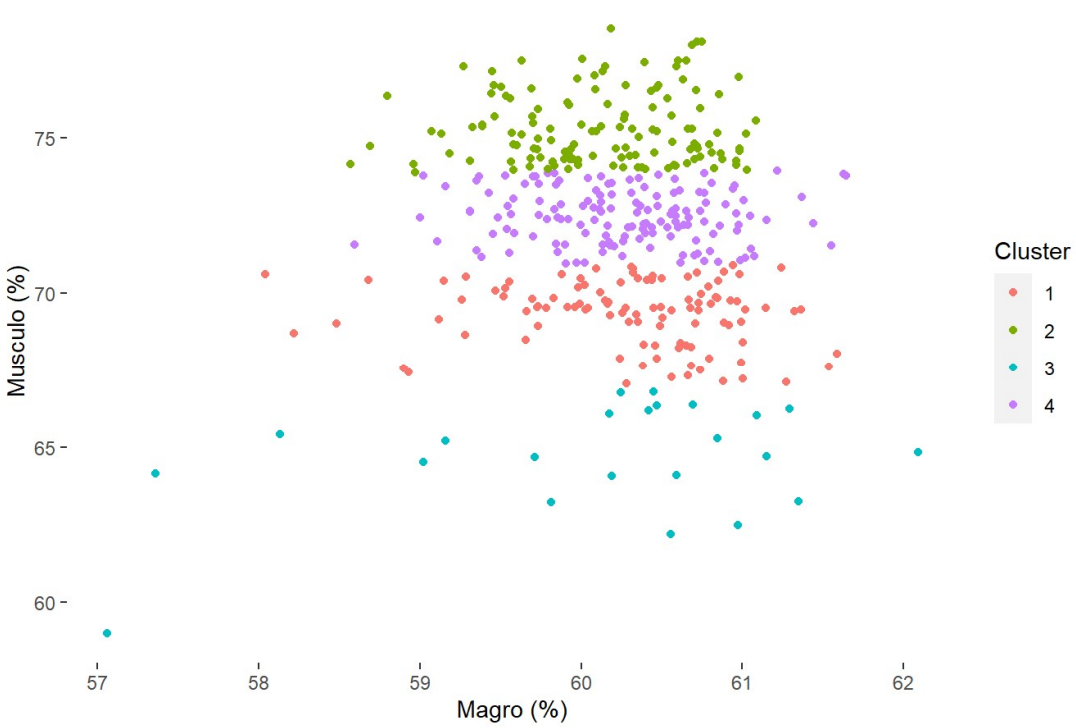
Can we use farm data to understand and control the problem?

Clustering algorithm for carcass quality

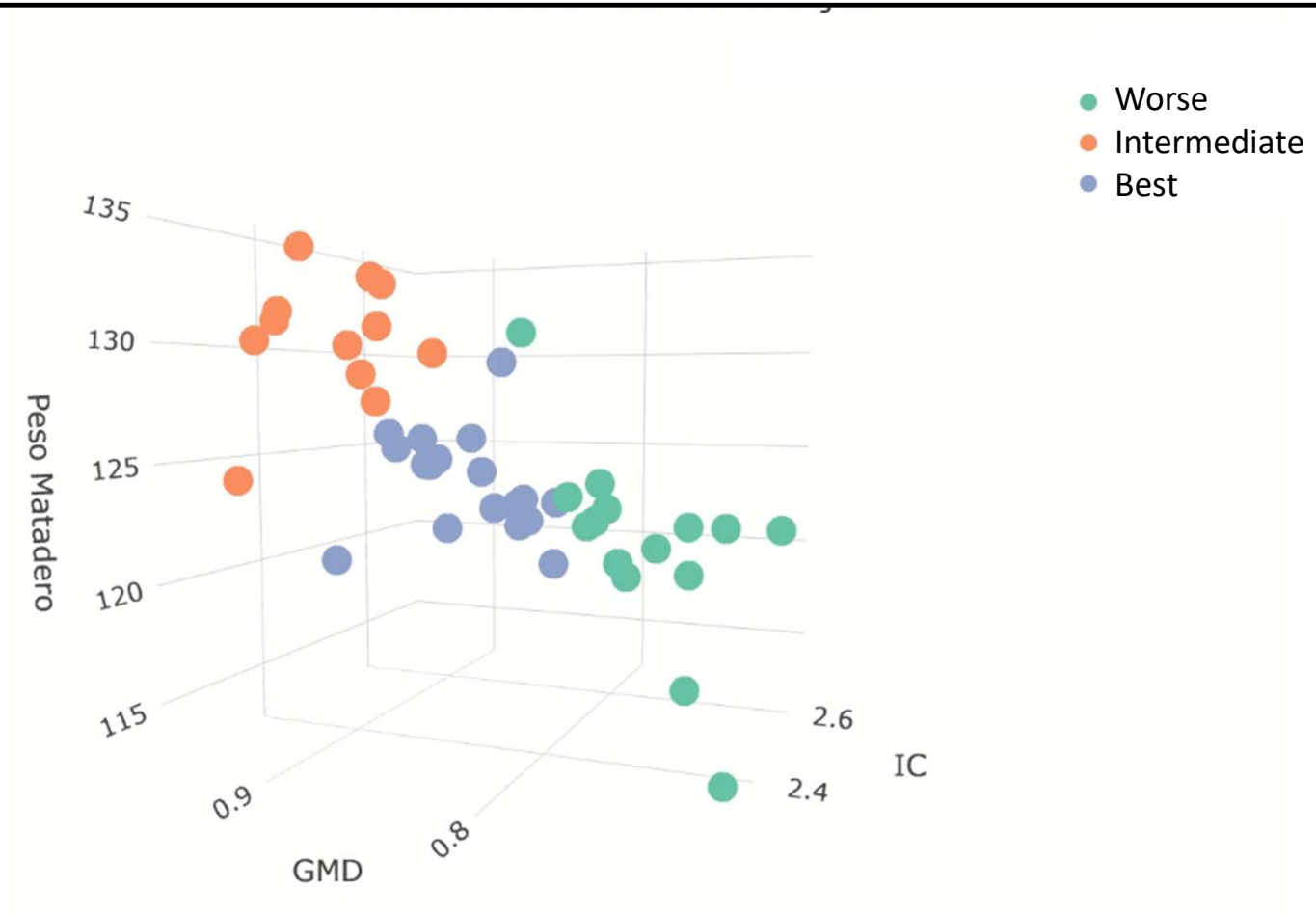
Gordura – Músculo



Magro – Músculo



Can we classify the performance of the farms considering several interest variables and the same time?

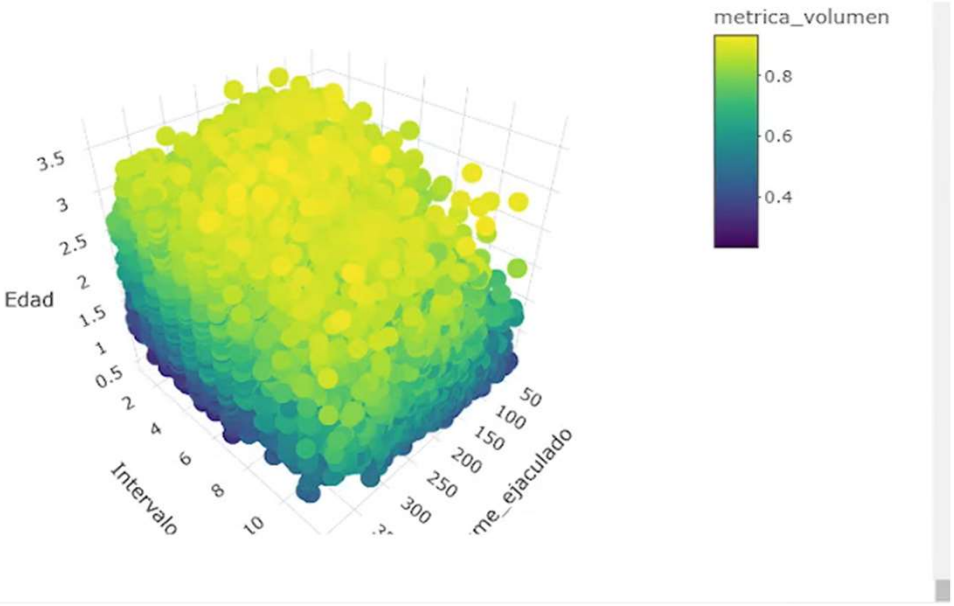


¿Which are the boars to collect and in what order?

We select the variables of interest and in order using different machine learning algorithms:

- Interval between collections (days)
- Age of males (years)
- Genetic index
- Volume (ml) and concentration (10^8 spz/ml)

From this we make an adjusted prediction of the male's behaviour in the next collection and optimise his performance.



We the vets are the right professionals to make the best of digitalization process

Take home

1. The industry's sustainability challenges can only be met by changing the business model to take advantage of the benefits of digitalisation.
2. It will bring greater efficiency, higher quality, better customer communication, brand enhancement, cost reduction and attraction of more qualified personnel.
3. We cannot afford not to face it. Failure to do so will start the countdown to the disappearance of the company because not being sustainable.
4. We the veterinarians and te producers are in the best position to promote this change towards sustainability improving our professional position to achieve it

Animal Data Analytics