Monitoring welfare and productivity of growing pigs

Nils Toft

(nt@IQinAbox.com)

IQinAbox

www.IQinAbox.com

Who is…



- Nils Toft
  - MSc Mathematics and Economics
  - PhD in Herd Management
  - 20 year+ career in Epidemiology
  - Professor at National Veterinary Institute, Technical University of Denmark
  - Last 4 years – partner and director in IQinAbox
- IQinAbox – Scientifically Based Monitoring
  - Danish Startup
  - Founded by Thomas Nejsum Madsen
  - Currently 7 people – with extensive experience in herd management, epidemiology, computer science and biology.

Cloud-based solution with stakeholder integration reduces the need for manual registrations



- Carcass weight
- Meat percentage

- Daily gain - FCR
- Delivery prognoses 12 w



- Feed deliveries
- Feed mix content

- FCR - Daily Gain
- Feed consumption prognoses
- Delivery planning

IQinAbox engine

Data cleansing
Analytics
Dynamic modelling



- Pig entries
- Dead pigs
- Status counts

- Daily gain – FCR
- Delivery prognoses 12 w

API integration

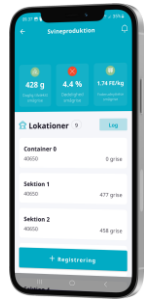
Online tools

Mobile tools

Other IT Solution

SPF Danmark
Microsoft Dynamics 365
SAP
CHR
Daka
cloudfarms





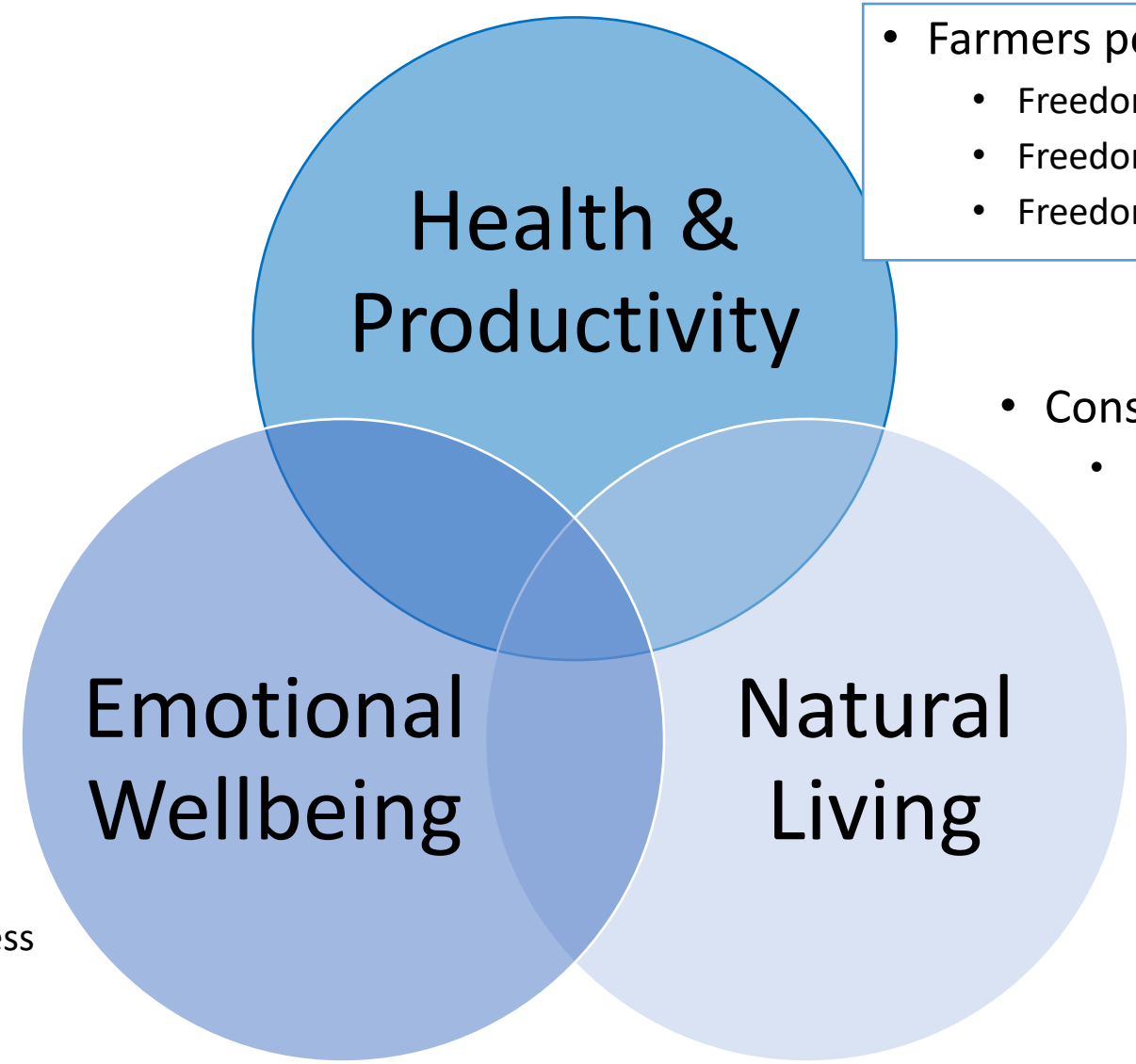
Animal Welfare

Five Freedoms

- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain, injury and disease
- Freedom to express normal behavior
- Freedom from fear and distress

Five Domains

- Nutrition
- Housing
- Health
- Behavior
- Mental state



- Farmers perception
  - Freedom from hunger and thirst
  - Freedom from discomfort
  - Freedom from pain, injury and disease

- Consumers perception
  - Freedom to express natural behavior

- Pet owners' perception
  - Freedom from fear and distress

Monitoring Water Intake in Pigs: Prediction of Disease and Stressors

Published by the American Society of Agricultural and Biological Engineers, St. Joseph, Michigan www.asabe.org



Computers and Electronics in Agriculture
Volume 48, Issue 2, August 2005, Pages 138-154



A model for monitoring the condition of young pigs by their drinking behaviour



Computers and Electronics in Agriculture
Volume 48, Issue 1, July 2005, Pages 39-61



Modelling the drinking patterns of young pigs using a state space model

Thomas Nejsum Madsen [a b], Søren Andersen [b], Anders Ringgaard Kristensen [a]

Show more

+ Add to Mendeley Share Cite

https://doi.org/10.1016/j.compag.2005.01.001

Get rights and content

Abstract

In normal situations pigs show a stable diurnal drinking pattern. Based on experimental data, a dynamic model is developed for prediction of the drinking behaviour of growing pigs. A state space model with cyclic components is proposed for modelling the diurnal drinking pattern, measured as hourly sums. Determination of variance structure by use of discount factors is suggested. Model performance is investigated by error analysis. The final model contains three *cyclic* components.

- Observation equation:

$$Y_t = \mathbf{F}'\boldsymbol{\theta}_t + v_t \qquad v_t \sim N(0, \phi^{-1}). \tag{5.16}$$

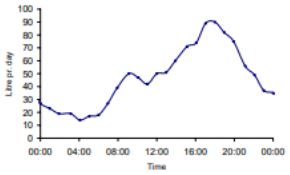
- System equation:

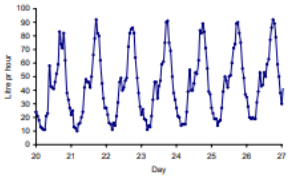
$$\boldsymbol{\theta}_t = \mathbf{G}\boldsymbol{\theta}_{t-1} + \mathbf{w}_t \qquad \mathbf{w}_t \sim T_{n_{t-1}}(0, \mathbf{W}). \tag{5.17}$$

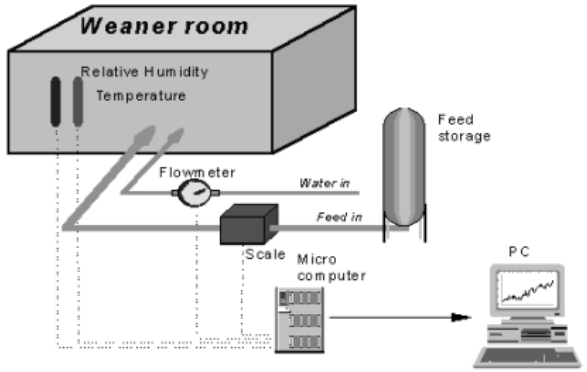
- Information:

$$(\boldsymbol{\theta}_{t-1} \mid D_{t-1}) \sim T_{n_{t-1}}(\mathbf{m}_{t-1}, \mathbf{C}_{t-1}), \tag{5.18}$$

$$(\phi \mid D_{t-1}) \sim G_{n_{t-1}}(\frac{n_{t-1}}{2}, \frac{n_{t-1}S_{t-1}}{2}), \tag{5.19}$$





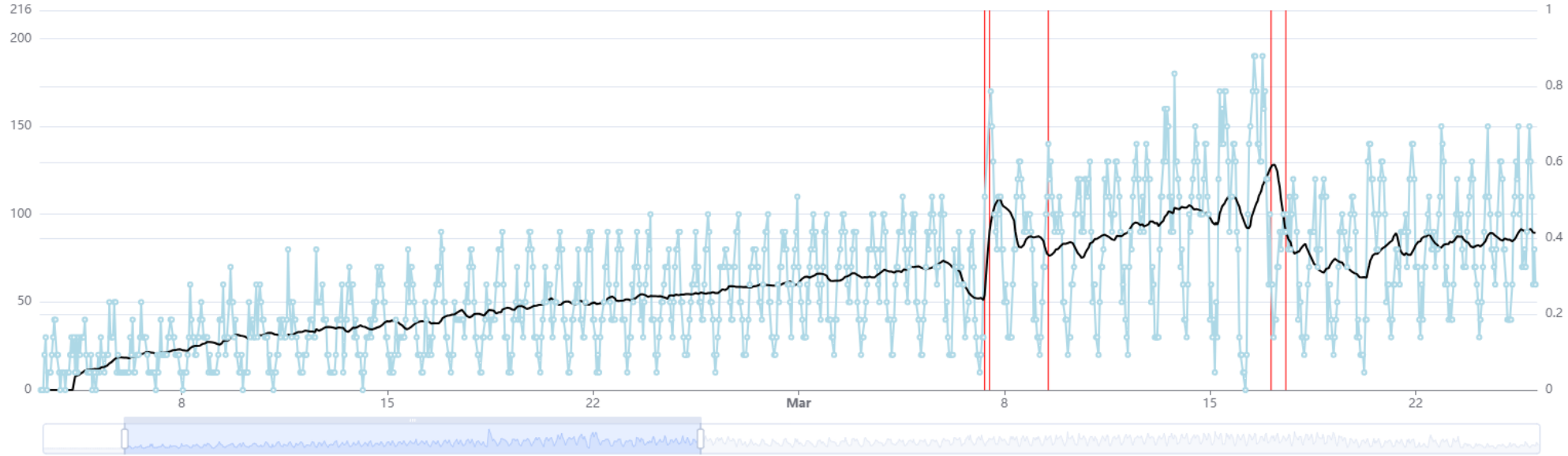




In the early 2000's the world had not moved to the Cloud – The first iPhone came in 2007.
Internet was not in the stable yet!

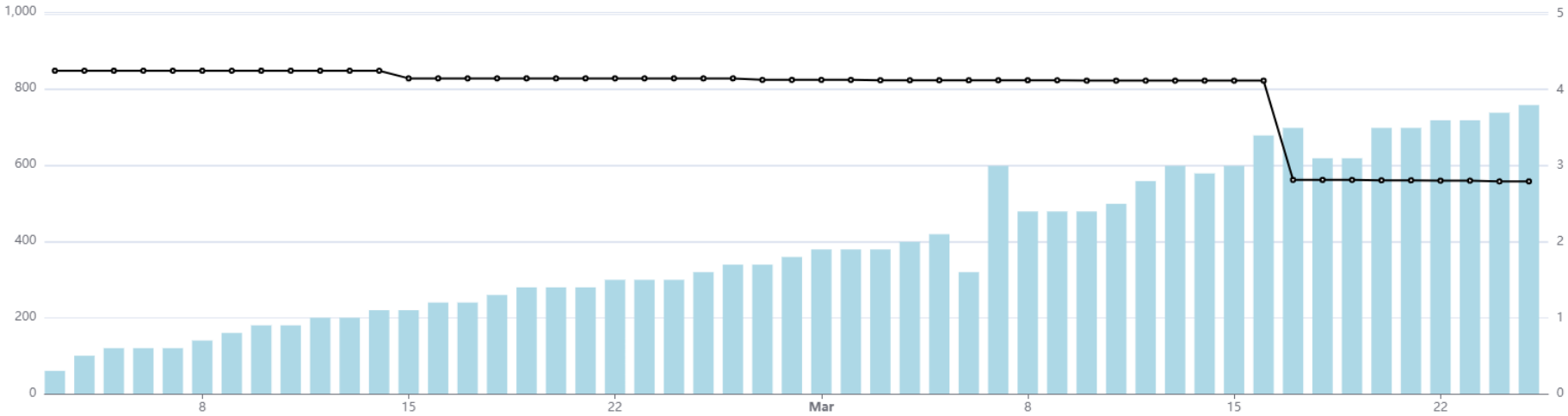
Skinken - Sektion 2

Start - 2023-02-03 Antal grise: 846 IndsÃ¦ttelsesvÃ¦gt: 5.7



Skinken - Sektion 2

Start - 2023-02-03 Antal grise: 846 IndsÃ¦ttelsesvÃ¦gt: 5.7



Keeping track of water intake to monitor pig performance

Quick facts

Monitoring daily water use in individual groups of pigs offers a low-cost, yet valuable way to observe and care for pigs. Charting water disappearance allows for quicker detection that something is harming pig performance. But it doesn't directly show what the problem is.

Research and field observations would show that monitoring water use is much more predictable and sensitive than monitoring feed intake. Monitoring water also takes little time to implement and maintain.

Drinkers and water quality | Feed and nutrition | Herd management

Monitoring Water Consumption to Assist Health Management

Automated monitoring of water consumption could provide a sensitive tool for real-time, continuous, monitoring for the presence of sub-clinical disease in growing herds, according to No. 14 in the 'Research into Action' series from BPEX.

27 February 2013 | 5 minute read | By: Barrie

The drinking behaviour of diseased pigs has been found to deviate from the consistent patterns seen in healthy pigs; the behavioural changes appear in the sub-clinical stage of infection, before disease symptoms become visually apparent. Therefore, the automated monitoring of water consumption could provide a sensitive tool for real-time, continuous, monitoring for the presence of sub-clinical disease in growing herds.

Previous work has examined changes within daily water consumption and found whole building and room consumption patterns to be sensitive indicators for all-in, all-out systems. Research at Newcastle University investigated the sensitivity of monitoring water on a more detailed level, using total daily water consumption at pen level, for deviations in daily water intake patterns that could indicate changes in health and performance.

Managing Water to Maximise Performance

Have you overlooked the most critical nutrient?

Water is the most critical nutrient to sustain life and plays a vital role in most biological functions across all phases of production. It is the largest single component of body composition and represents between 50-80% of body content depending on age. With this article we take a closer look at the key drivers behind water intake in pigs.

- Drinker availability
- Drinker position and design
- Water flow
- Water quality

Drinker Availability

PIC recommends a ratio of 10 – 12 pigs per water source in nursery pigs (up to 30kg) and grow-finish pigs (30kg to slaughter).



A swinging nipple can be added in high stocking density situations to ensure proper drinker availability.

Revista Brasileira de Zootecnia

Brazilian Journal of Animal Science
ISSN 1806-9290
www.rbz.org.br

The importance of water in pig farming

V.I. Komlatsky*, *G.V.* Komlatsky, *O.N.* Eremenko, *R.V.* Elizbarov, and *S.A.* Aksenenko

Kuban State Agrarian University named after I.T. Trubilin, city of Krasnodar, Russia

Abstract. Water is an extremely important element of metabolism in the body of pigs during ontogenesis. It acts as a transport and solvent medium for nutrients and waste products; improves the digestive system; provides a normal balance of electrolytes and mobility of joints; regulates body temperature; serves as a conductor of biochemical reactions. Pigs' need for water depends on many factors, including feed type, ambient temperature, and general health. Observations of the water consumption of pregnant sows indicate that the ratio of water and feed is stable in sows of the first and second farrowing, and water consumption increases further with each farrowing. The lactating animal should consume up to 40 liters of water per day. In weaning pigs and pigs for fattening, the maximum consumption is noted at the beginning and at the end of the period. Ethological observations have found that animals imitate each other when drinking, showing a herd reflex. With population increase in the group, water consumption increases. The dynamics of the process is influenced by feed type and feeding method. Lack of water leads to dehydration, which affects the behavior of pigs.

Non-ruminants
Full-length research article

Water disappearance dynamics in growing-finishing pig production

Michael Chimainski[1], Marcos Speroni Ceron[2], Micheli Faccin Kuhn[1], Henrique da Costa Mendes Muniz[1], Leonardo Tombesi da Rocha[1*], Paulo Santana Pacheco[1], Alexandre de Mello Kessler[3], Vladimir de Oliveira[1]

[1] Universidade Federal de Santa Maria, Departamento de Zootecnia, Santa Maria, RS, Brasil.
[2] Universidade José do Rosário Vellano, Faculdade de Agronomia, Alfenas, MG, Brasil.
[3] Universidade Federal do Rio Grande do Sul, Departamento de Zootecnia, Porto Alegre, RS, Brasil.

ELSEVIER

The Veterinary Journal
Volume 217, November 2016, Pages 43-51

Review

Early detection of health and welfare compromises through automated detection of behavioural changes in pigs

Stephen G. Matthews [a], Amy L. Miller [b], James Clapp [b], Thomas Plötz [a], Ilias Kyriazakis [b]

Show more

+ Add to Mendeley Share Cite

Open Access Review

Information Technologies for Welfare Monitoring in Pigs and Their Relation to Welfare Quality®

by Mona L. V. Larsen * , Meiqing Wang and Tomas Norton

Group M3-BIORES: Measure, Model and Manage Bioresponses, Division Animal and Human Health Engineering, Department of Biosystems, KU Leuven, Kasteelpark Arenberg 30, 3001 Heverlee, Belgium

* Author to whom correspondence should be addressed.

Sustainability **2021**, *13*(2), 692; https://doi.org/10.3390/su13020692

Received: 28 October 2020 / Revised: 4 January 2021 / Accepted: 5 January 2021 / Published: 12 January 2021

(This article belongs to the Special Issue Precision Agricultural Technologies for Sustainable Controlled Environment Agriculture)

Download Browse Figures Versions Notes

ORIGINAL RESEARCH article

Front. Anim. Sci., 06 May 2022
Sec. Animal Welfare and Policy
Volume 3 - 2022 | https://doi.org/10.3389/fanim.2022.874260

This article is part of the Research Topic
Animal Welfare Labelling
View all 5 Articles

How Far Are We From Data-Driven and Animal-Based Welfare Assessment? A Critical Analysis of European Quality Schemes

Anna H. Stygar[1*] Caspar Krampe[2] Pol Llonch[3] Jarkko K. Niemi[1]

[1] Bioeconomy and Environment, Natural Resources Institute Finland (Luke), Helsinki, Finland
[2] Marketing and Consumer Behaviour Group, Department of Social Science, Wageningen University, Wageningen, Netherlands
[3] Animal Welfare and Nutrition Service (SNiBA), Department of Animal and Food Science, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain

SYSTEMATIC REVIEW article

Front. Vet. Sci., 14 May 2021
Sec. Animal Behavior and Welfare
Volume 8 - 2021 | https://doi.org/10.3389/fvets.2021.660565

This article is part of the Research Topic
Animal Welfare Assessment, Volume II
View all 14 Articles

A Systematic Review on Validated Precision Livestock Farming Technologies for Pig Production and Its Potential to Assess Animal Welfare

Yaneth Gómez[1*] Anna H. Stygar[2] Iris J. M. M. Boumans[3] Eddie A. M. Bokkers[3] Lene J. Pedersen[4]
Jarkko K. Niemi[2] Matti Pastell[5] Xavier Manteca[1] Pol Llonch[1]

[1] Department of Animal and Food Science, Universitat Autònoma de Barcelona, Barcelona, Spain
[2] Bioeconomy and Environment, Natural Resources Institute Finland (Luke), Helsinki, Finland
[3] Animal Production Systems Group, Wageningen University and Research, Wageningen, Netherlands
[4] Department of Animal Science, Aarhus University, Tjele, Denmark
[5] Production Systems, Natural Resources Institute Finland (Luke), Helsinki, Finland

REVIEW article

Front. Vet. Sci., 27 May 2022
Sec. Animal Behavior and Welfare
Volume 9 - 2022 | https://doi.org/10.3389/fvets.2022.889623

This article is part of the Research Topic
Animal Welfare Science: Rising to the Challenges of a Changing World
View all 6 Articles >

Twelve Threats of Precision Livestock Farming (PLF) for Animal Welfare

 Frank A. M. Tuyttens[1,2*]  Carla F. M. Molento[3]  Said Benaissa[1,4]

Direct Negative Effects

- Technical failures
- System effect on animals
- Poor external validation
- Measurable rather than meaningful

Impact of PLF on End-Users

- Over- or under reliance on PLF
- Less (quality)time with animals
- End-user profile and skill

Potential transformation of farming

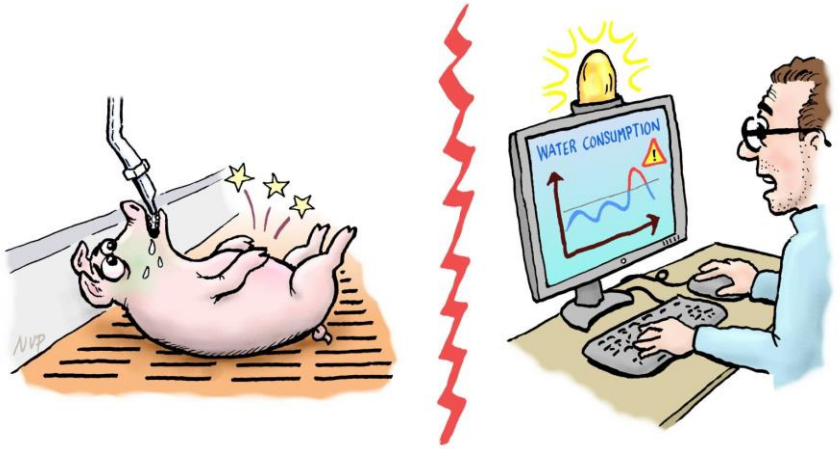
- Housing and management adapted to PLF rather than animals
- Facilitation of Intensive Systems

Affecting moral status of animals

- Speciesism
- Animal Instrumentalization
- Promotion of animal consumption and harm

Challenges with Automatic Monitoring

- What the sensors tell us is only part of the picture
- The drinking pattern changed
  - Did you move pigs in/out?
  - Did you change the feed?
  - Did the silo run empty?
  - Did you add something to the water?

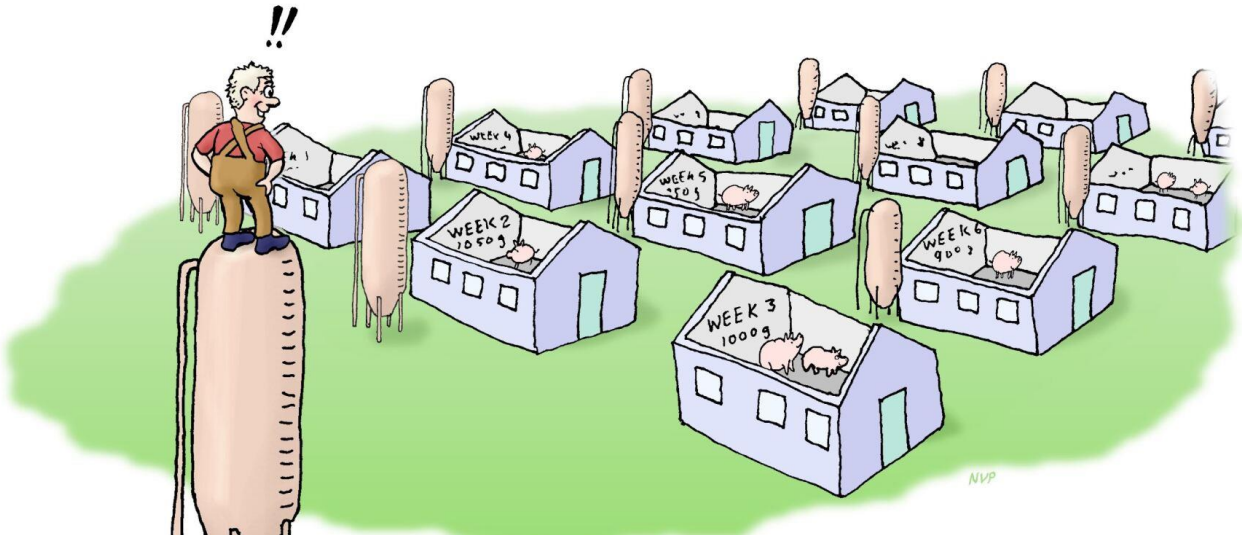


- The full story is needed to process the information from sensors into optimal decisions

The challenge with the full story

- No one likes to do things repeatedly
- Stand alone versions of sensor software requires information that is also needed for your management system

- So if your management system gets data in real-time..



Cloud-based solution with stakeholder integration reduces the need for manual registrations



- Carcass weight
- Meat percentage

- Daily gain - FCR
- Delivery prognoses 12 w



- Feed deliveries
- Feed mix content

- FCR - Daily Gain
- Feed consumption prognoses
- Delivery planning



- Pig entries
- Dead pigs
- Status counts

- Daily gain – FCR
- Delivery prognoses 12 w

IQinAbox engine

Data cleansing
Analytics
Dynamic modelling

API integration

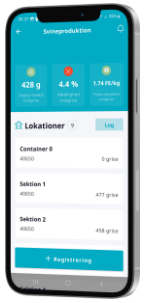
Online tools

Mobile tools

Other IT Solution

SPF Danmark
Microsoft Dynamics 365
SAP
CHR
Daka
cloudfarms





Overview
Log
Production data
Pigs
Feed
Economy
Slaughters
Reports

PIGS365
Powered by IQinAbox

3,444 pcs
Weaners

414 g
Daily gain weaners

1.84 FU/kg
Feed conversion weaners

2.4 %
Mortality weaners

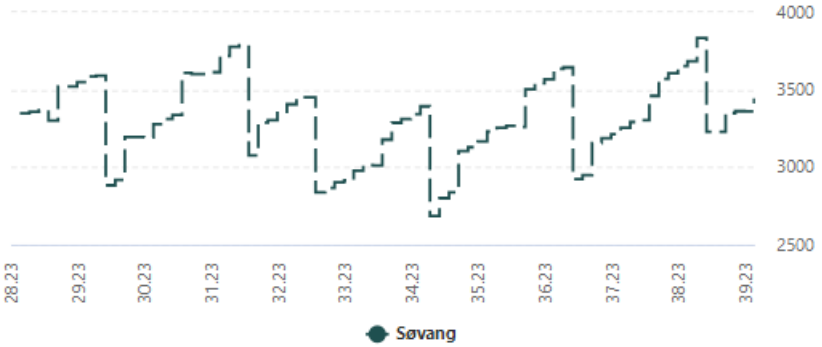
Overview

Slaughter pigs | Weaners

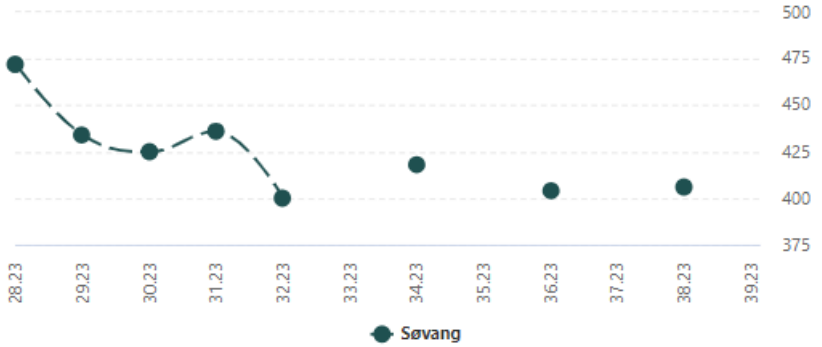
From: 07/10/2023

To: 09/25/2023

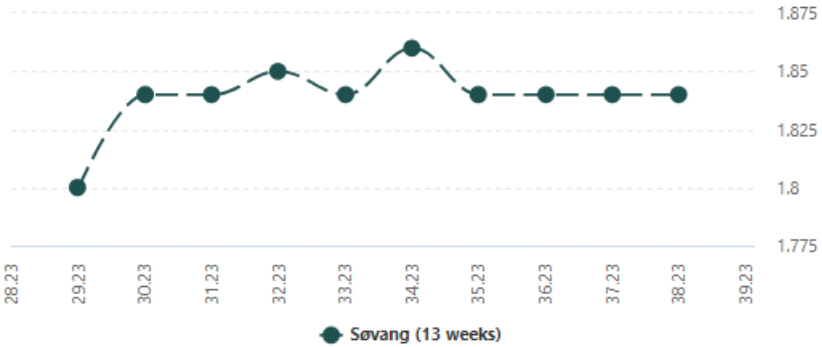
Number of weaners (pcs)



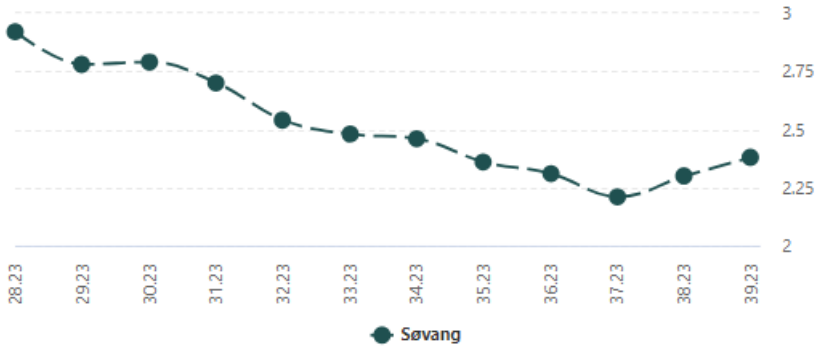
Daily gain (g)



Feed conversion (FU/kg)



Mortality (%)



The IQinAbox solution is already running successfully

KLS DATA Powered by IQinAbox

Danish Crown DATA Powered by IQinAbox

PIGS365 Powered by IQinAbox

dlg

Danish Agro

Danish Crown

BAT AGRAR

VA

DanePork

BRØDR. EWERS A/S EWERS - fordi kvalitet gi'r resultater

Tican

SB PORK

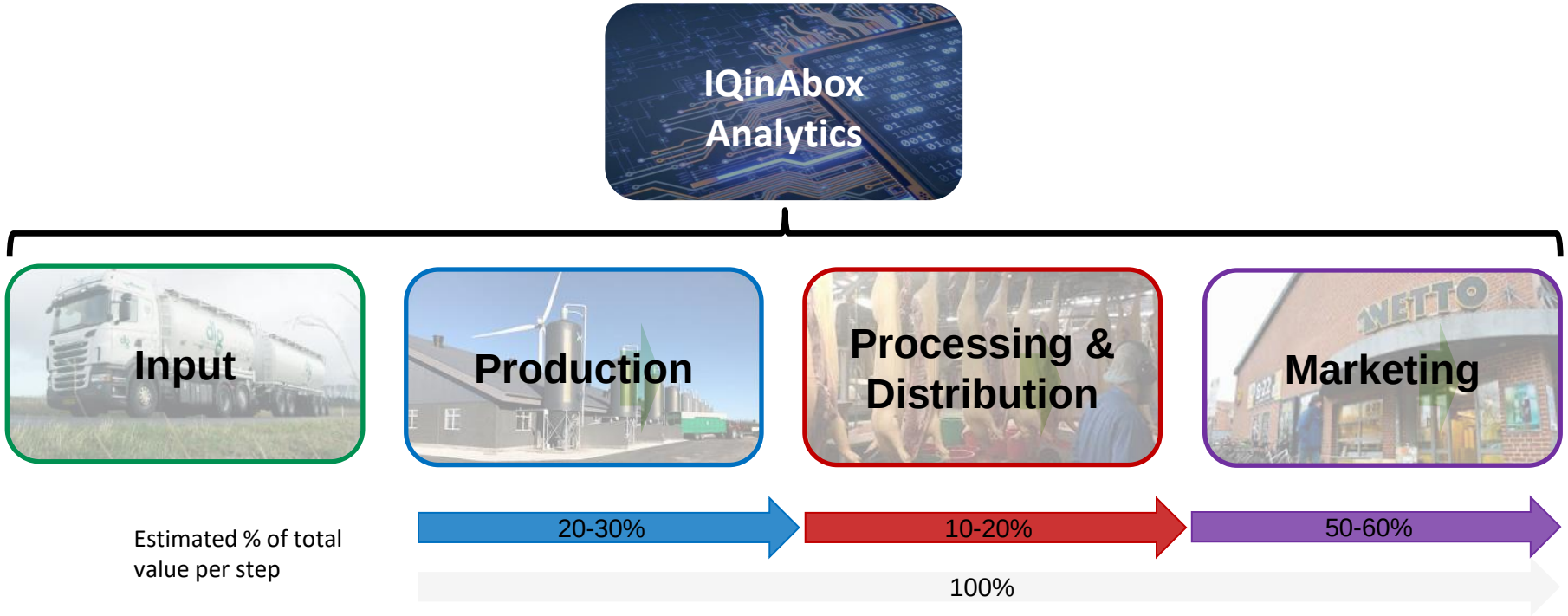
Current integrations:

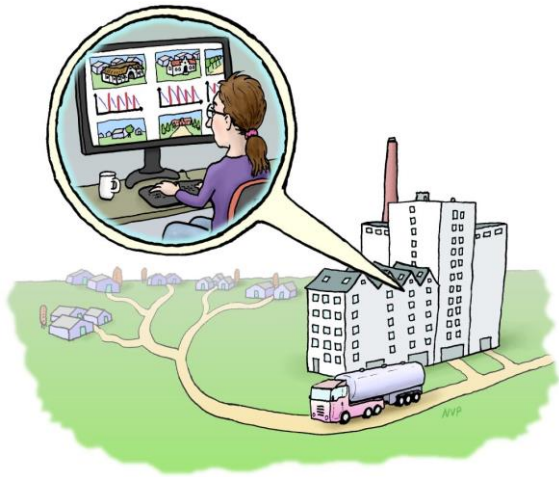
- More than 40.000 pigs* slaughtered every day in Denmark
- 1.400 farms running on the solution
- More than 4.000 tons* of feed-ordering every day in Denmark

*) Approx. 80% of DK production

Challenges or opportunities!

1. Pig production lags many other industries and the use of data to optimize each step is under-utilized
2. Large integrators have better control of the steps in the value chain, giving them a competitive advantage over more “co-operative based countries”
3. Information across the value chain is needed for documentation





Based on “A Value Chain Analysis of the U.S. Pork Industry” And Pork Value Chains: A Comparison of Catalonia, Spain and Manitoba, Canada”

Danish pig production expect 25 million Euro in annual savings – based on the IQinAbox digitalization platform

- IQinAbox has digitized the Danish finisher production together with Danish Crown
- The data platform is the driver of a complete digitalization process covering farms, feed suppliers and slaughterhouses.
- Estimated gain 1**.5 euro per finisher pig;**
  - Dynamic KPI's – updated every day
  - Dynamic feed mix optimization
  - Monitoring silo content without any equipment
  - Delivery forecasts for slaughter
- Documenting climate impact at batch level
- Documenting prudent use of antibiotics







Danish Crown: "Our farmers can optimize for 1.5 Euro per pig"

Overview
Log
Production data
Pigs
Feed
Economy
Slaughters
Reports

PIGS365
Powered by IQinAbox

3,444 pcs
Weaners

414 g
Daily gain weaners

1.84 FU/kg
Feed conversion weaners

2.4 %
Mortality weaners

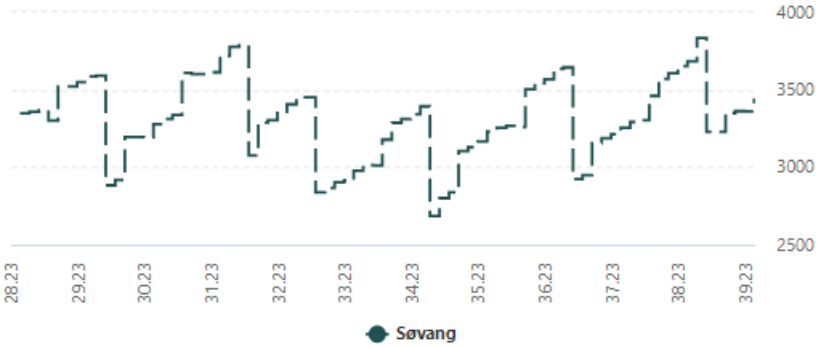
Overview

Slaughter pigs | Weaners

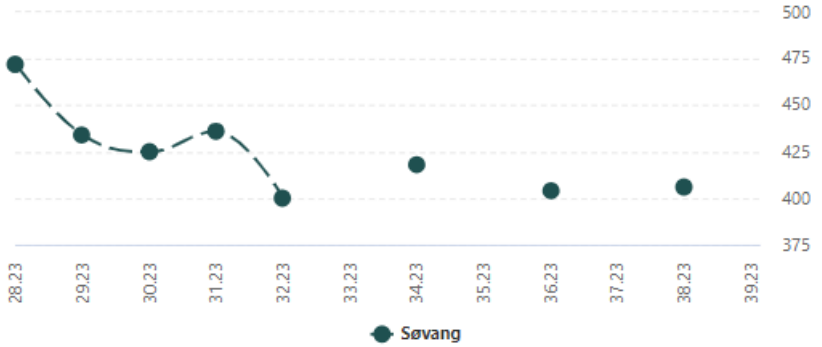
From: 07/10/2023

To: 09/25/2023

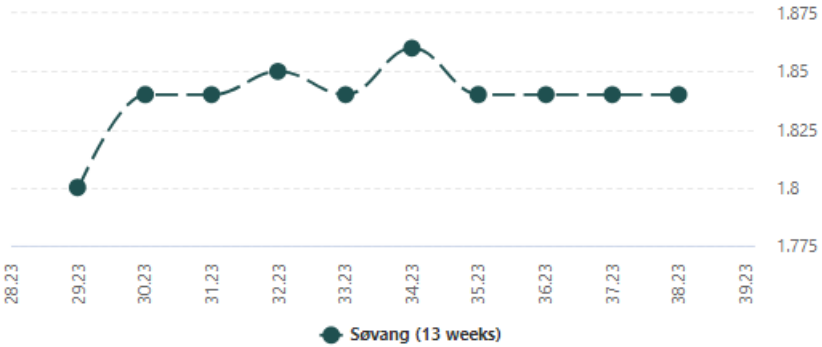
Number of weaners (pcs)



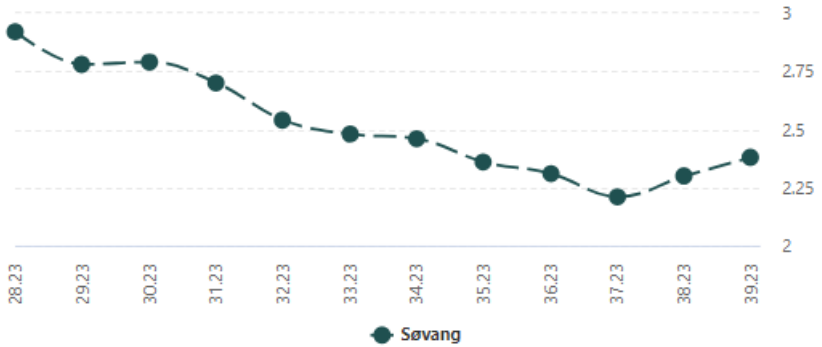
Daily gain (g)



Feed conversion (FU/kg)

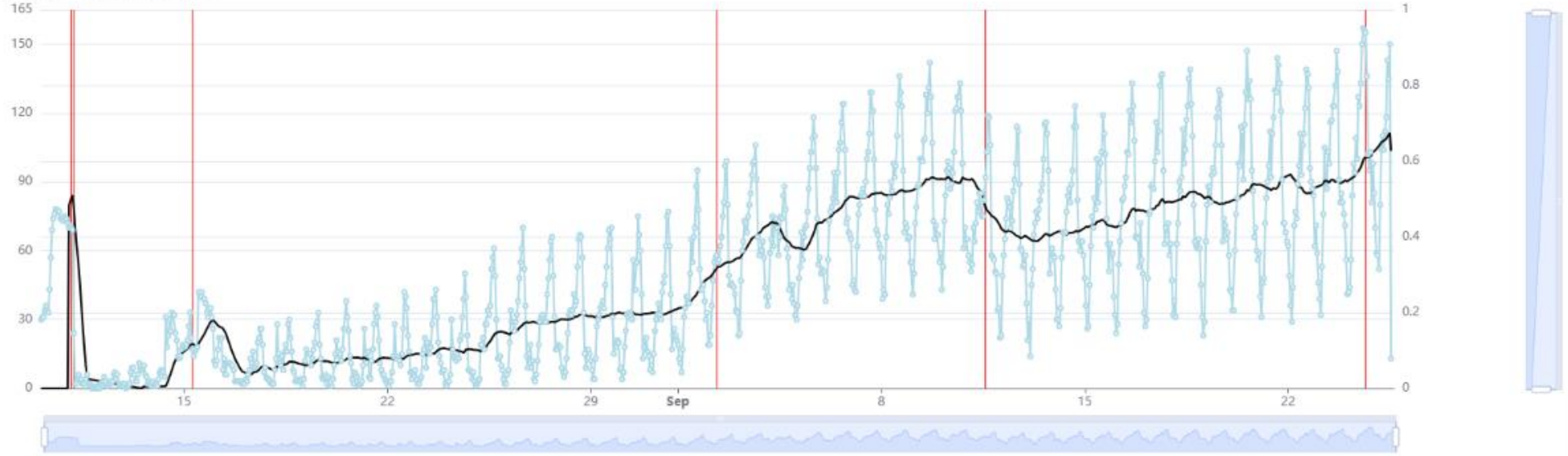


Mortality (%)



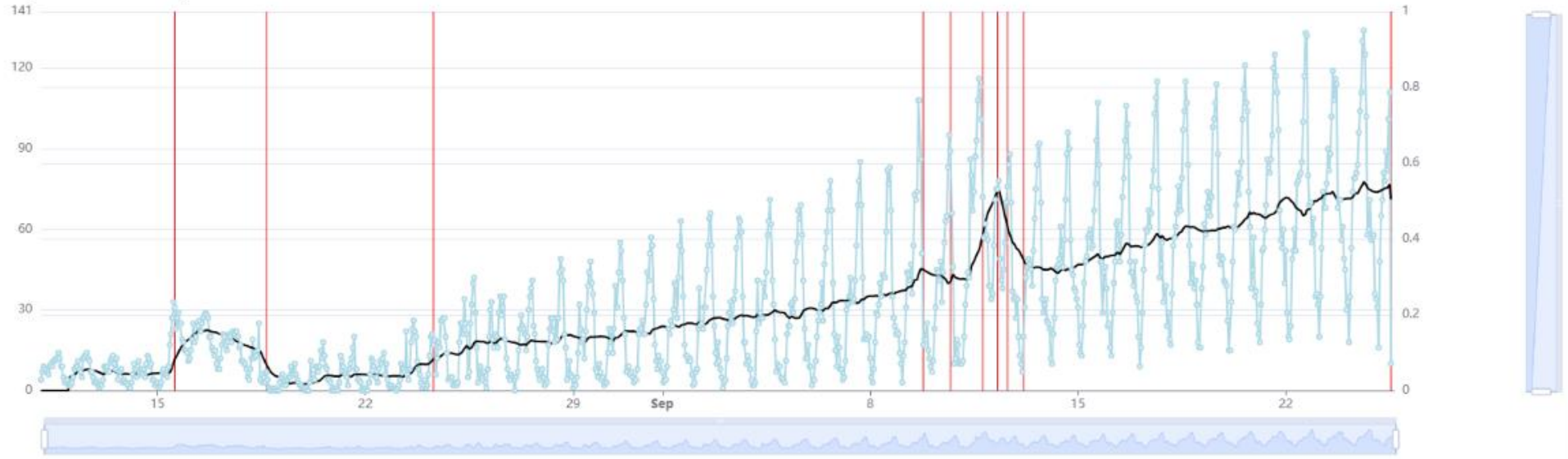
Søvang - Sektion 2

Start - 2023-08-11 Antal grise: 460 Indsættelsesvægt: 6.1



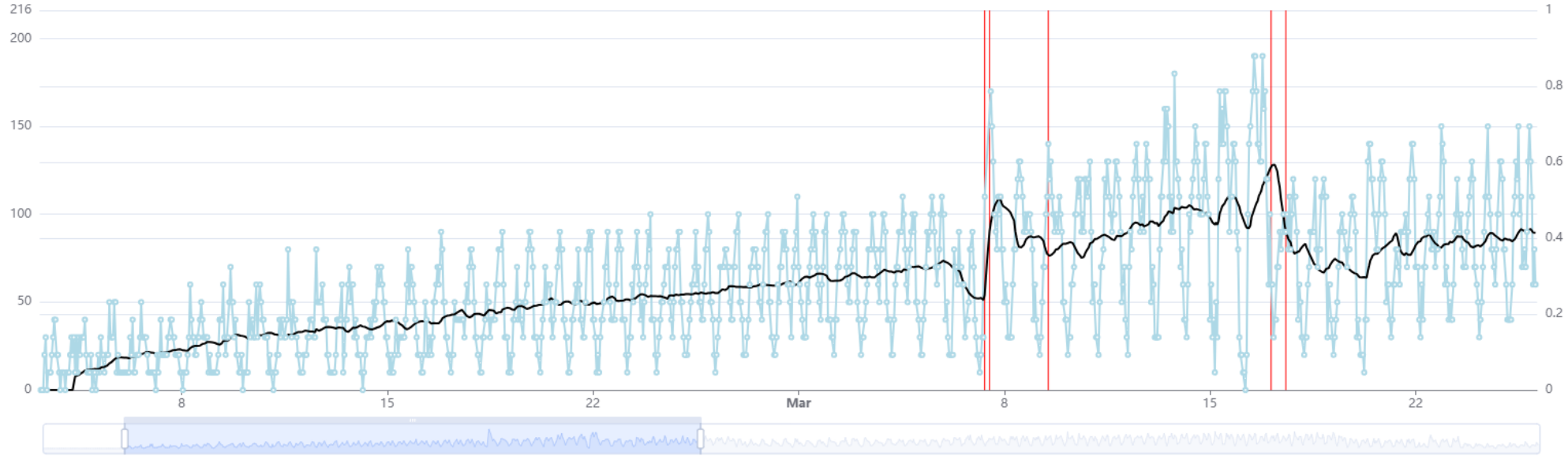
Søvang - Sektion 3

Start - 2023-08-18 Antal grise: 485 Indsættelsesvægt: 6.2



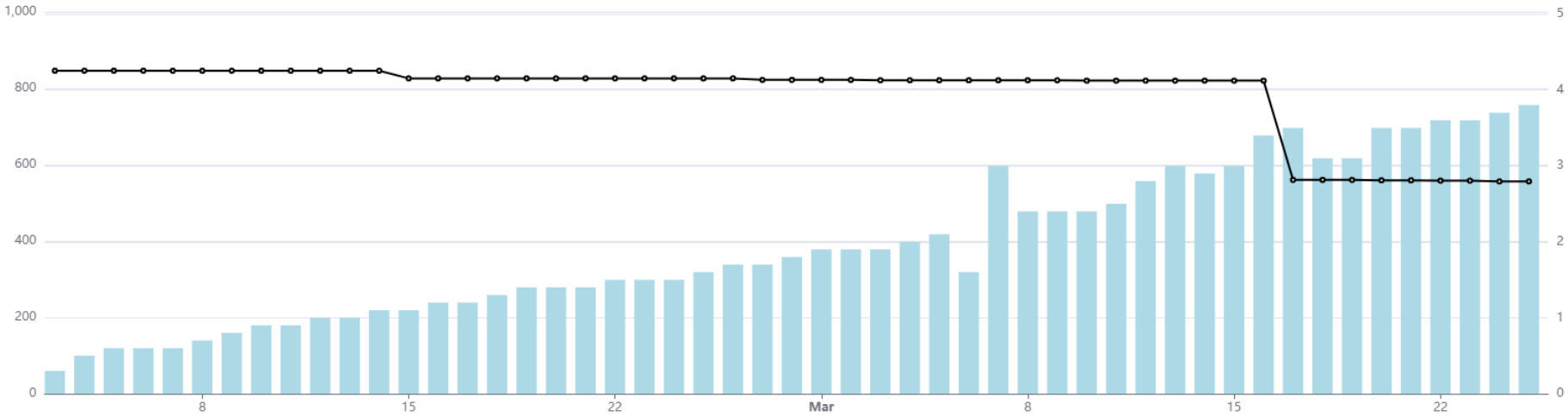
Skinken - Sektion 2

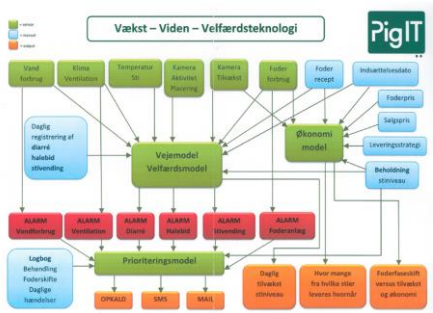
Start - 2023-02-03 Antal grise: 846 IndsÃ¦ttelsesvÃ¦gt: 5.7



Skinken - Sektion 2

Start - 2023-02-03 Antal grise: 846 IndsÃ¦ttelsesvÃ¦gt: 5.7





Modelling



Researchers

Implementation

Data

IoT hub

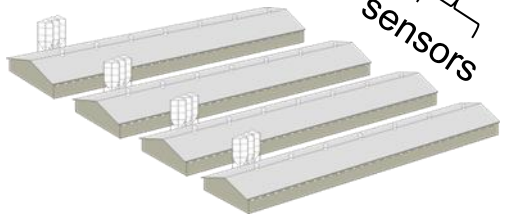
Cloud

Output



IoT box

sensors

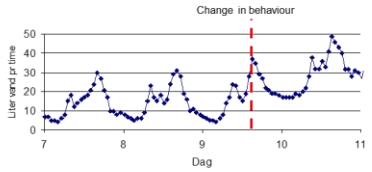


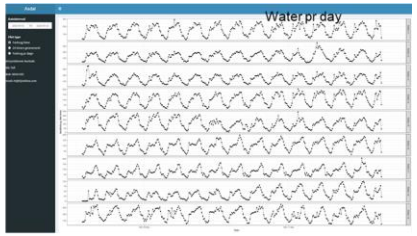
Feedback

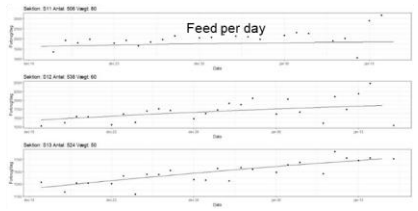


Our learnings so far.



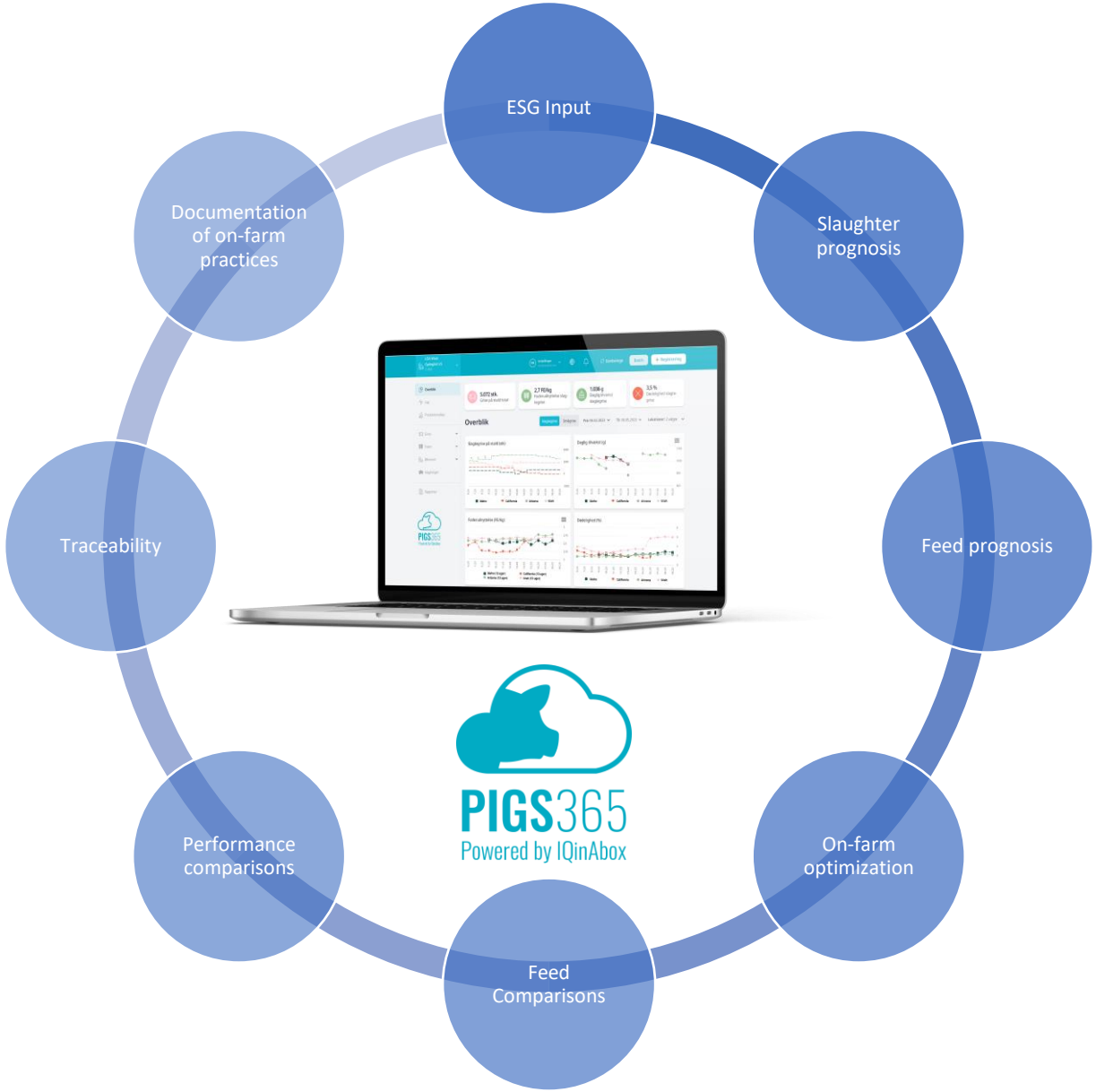








- IoT-technology has matured and become affordable
- Drinking patterns are strong indicators of the pigs well being
- Feed intake are closely related to growth rate


ESG Input
Slaughter prognosis
Feed prognosis
On-farm optimization
Feed Comparisons
Performance comparisons
Traceability
Documentation of on-farm practices
PIGS365
Powered by IQinAbox