

# From raw data to optimal sow replacement decisions - an integrated solution

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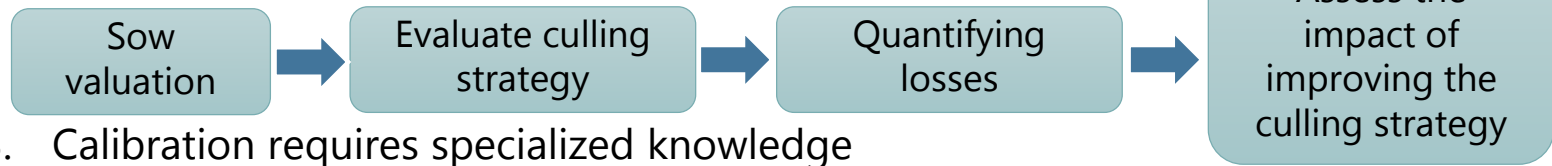


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# Introduction

## Background

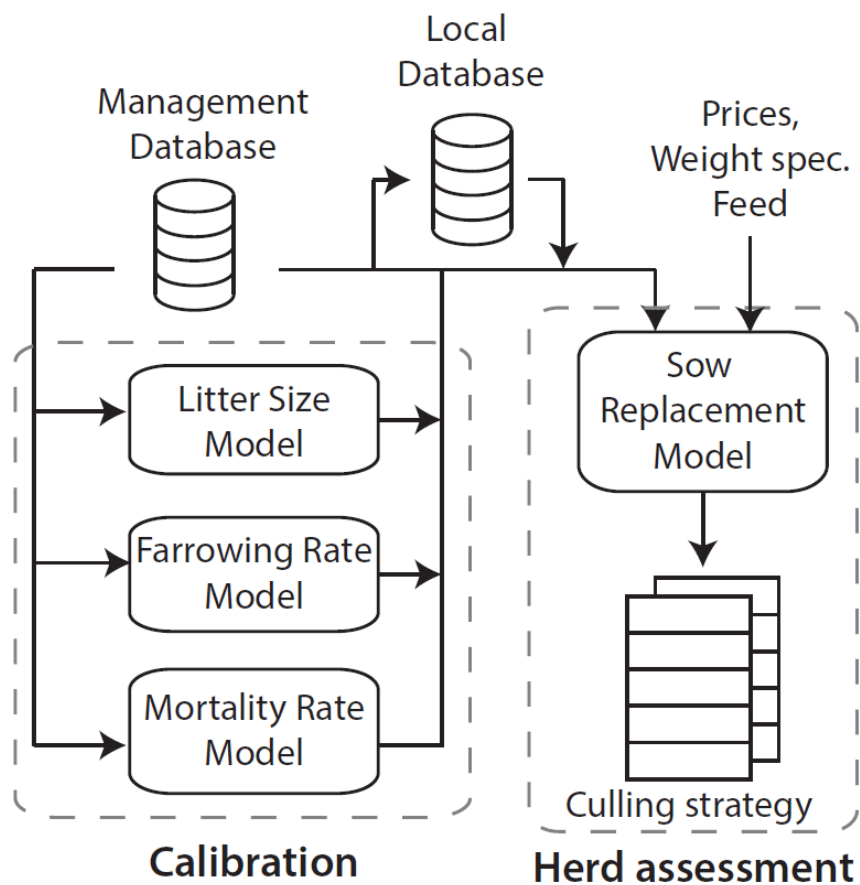
- Sow replacement model<sup>[1]</sup>
  1. Applied in the context of herd analysis
  2. Experiences



## Objective

- Develop a an integrated ITC tool to improve culling strategies
  1. Automatic calibration of the replacement model to the individual herd
  2. Direct integration with commercial management information software
  3. Design a user-friendly interface
  4. Performance of each individual animal

# System Design



## Outcome

- Current animals
- Culled animals
- (Dynamic monitoring system)

# Dynamic Monitoring System

- Herd specific trends using Dynamic Linear Models<sup>[2]</sup>
  - State-space based dynamic regression

$$Y_t = \mathbf{F}_t^T \boldsymbol{\theta}_t + \varepsilon_t \quad (\text{observation equation})$$

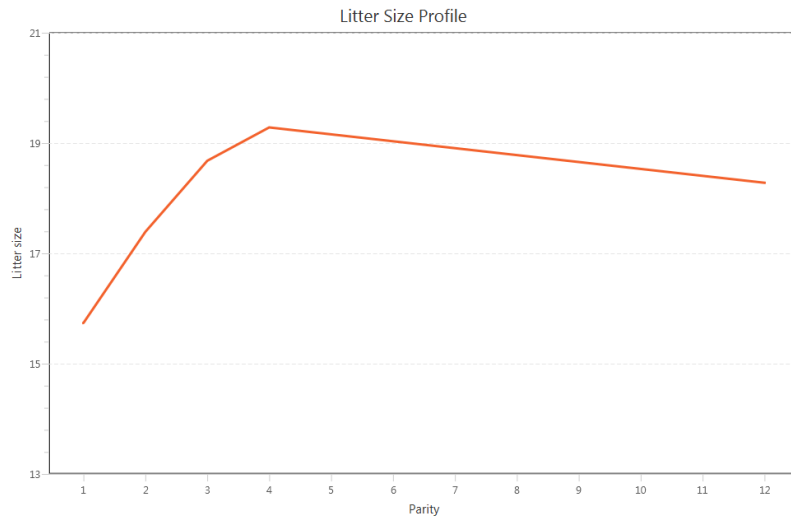
$$\boldsymbol{\theta}_t = \mathbf{G}_t \boldsymbol{\theta}_{t-1} + \boldsymbol{\omega}_t \quad (\text{evolution equation})$$

where

- $\boldsymbol{\theta}_t$  is the state vector,
- $\mathbf{F}_t$  is the regression vector
- $\mathbf{G}_t$  is the state matrix
- Updated in line with new data being available
- Provide a dynamic monitoring system
  - Also provides useful estimates not used for calibration

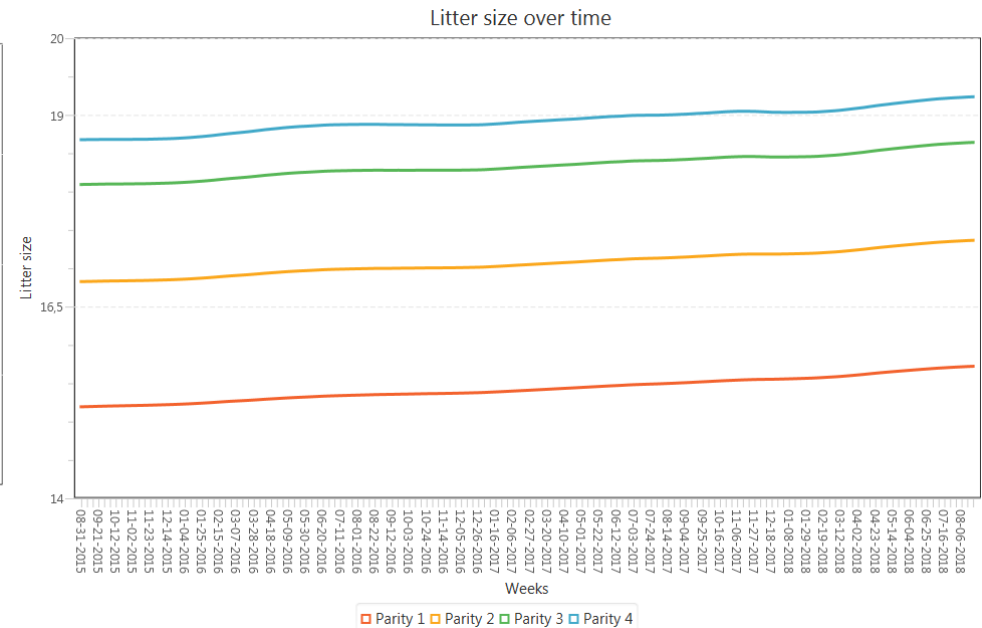
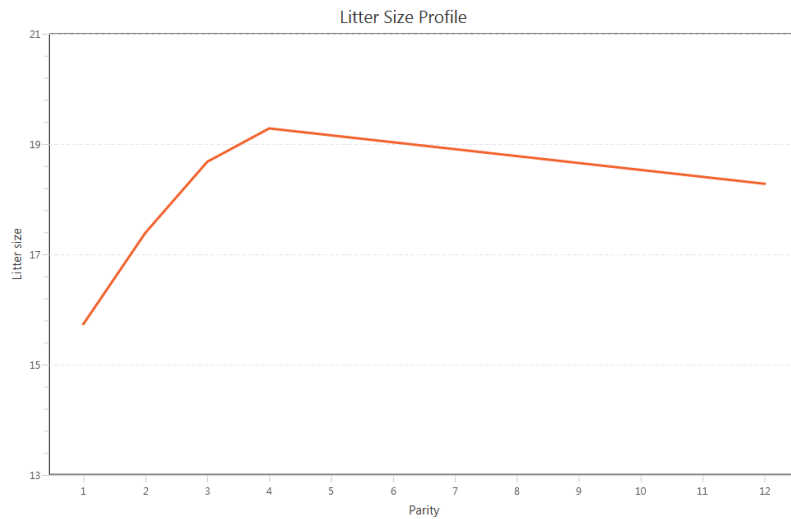
# Results

- Dynamic monitoring system



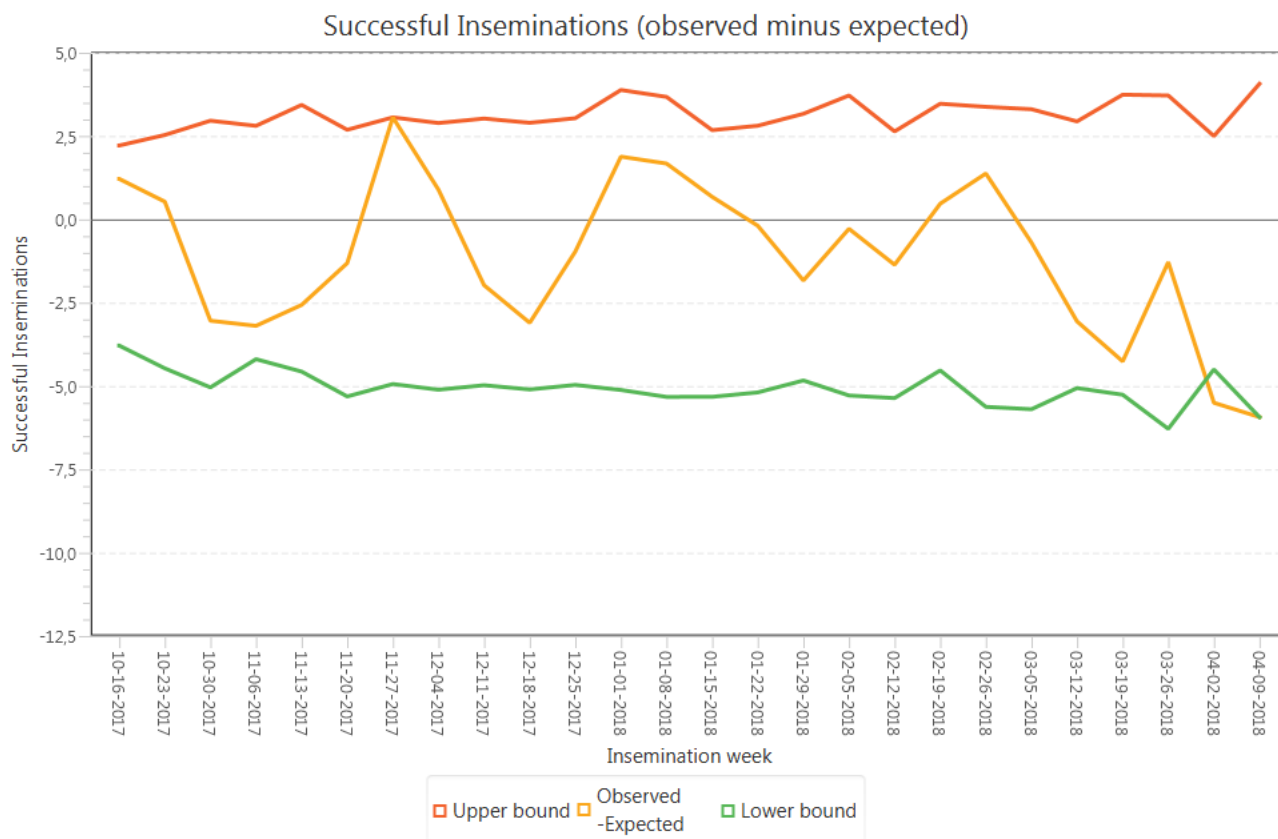
# Results

- Dynamic monitoring system



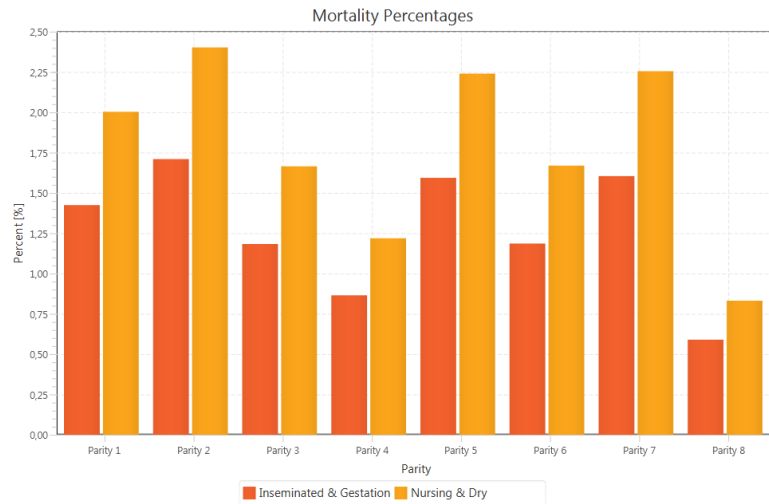
# Results

- Dynamic monitoring system



# Results

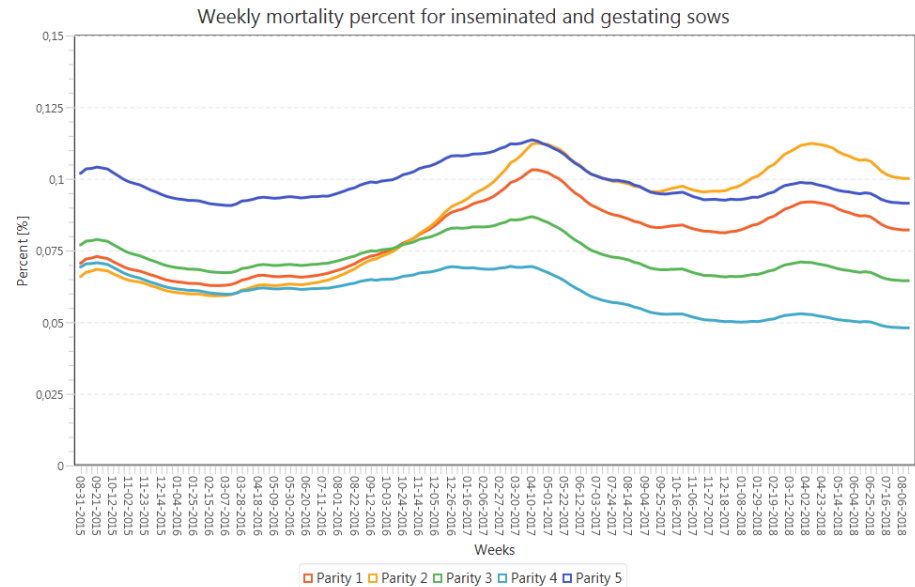
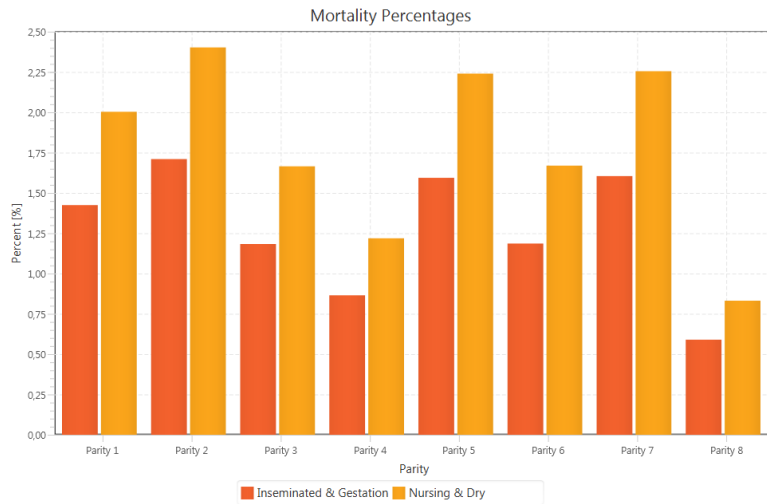
- Dynamic monitoring system





# Results

- Dynamic monitoring system



# User interface – decision support

File Help

Herd Culling Plot Settings

Active Sows

Sow ID

Dates

Value (EUR)  -

Event

Parity

Details

Litter size history:

Internal ID:

Animals 483  
Last updated: 08-27-2018

Sow ID	Parity	Inseminations	Potential	Value (EUR)	Event	Event date
4119	3	0	1,09	181,35	Weaned	08-21-2018
4149	2	1	0,11	106,45	Inseminated	05-01-2018
4118	3	0	-0,65	64,44	Weaned	08-17-2018
4120	3	0	1,21	203,49	Farrowed	08-17-2018
4117	3	0	-1,01	49,82	Weaned	08-16-2018
4101	3	0	1,07	181,35	Weaned	08-16-2018
4112	3	0	-1,28	36,98	Weaned	08-14-2018
4093	3	1	0,52	116,52	Inseminated	08-12-2018
4094	3	1	1,45	187,91	Inseminated	08-05-2018
4163	3	0	-2,30	-2,01	Weaned	08-21-2018
4095	3	1	0,79	132,47	Inseminated	08-04-2018
4116	3	1	-0,27	74,81	Inseminated	08-10-2018
4142	3	0	-1,14	36,98	Farrowed	08-05-2018
4141	3	0	-0,34	93,03	Farrowed	08-10-2018
4109	3	0	1,09	181,35	Weaned	08-21-2018
4121	3	0	0,97	181,35	Weaned	08-16-2018
4196	2	1	1,63	225,41	Inseminated	05-26-2018
4083	3	1	2,12	216,05	Inseminated	08-04-2018
4072	3	1	1,57	187,91	Inseminated	06-30-2018
4080	3	1	0,55	116,52	Inseminated	06-23-2018
4128	2	1	1,34	198,87	Inseminated	05-20-2018
4104	3	1	0,45	116,52	Inseminated	07-28-2018
4088	3	0	0,81	181,35	Weaned	08-21-2018
4146	3	0	0,76	161,25	Weaned	08-14-2018

# User interface – culling history

File Help

Herd Culling Plot Settings

Animals 4650  
Last updated: 08-27-2018

## Culled Sows

Sow ID

Dates

Value (EUR)  -

Culling type

Parity

---

**Loss due to non-optimal culling**

Culled too early	245086
Dead sows (lost slaughter value)	57079
Culled gilts (incl. dead)	24852
<b>Total loss (EUR)</b>	<b>327017</b>

Sow ID	Parity	Inseminations	Potential	Value (EUR)	Culling type	Culling date
1006	0	1	0,00	47,22	Slaughtered	07-18-2009
1005	2	0	0,84	192,28	Slaughtered	03-28-2010
1004	4	1	0,55	68,97	Slaughtered	04-17-2011
1003	2	1	-0,71	59,97	Slaughtered	05-02-2010
1002	2	0	-0,74	77,61	Slaughtered	03-28-2010
1001	3	0	-0,65	64,44	Slaughtered	08-23-2010
1000	1	1	0,08	106,63	Dead/Euthanized	11-13-2009
999	3	1	-1,33	30,51	Slaughtered	10-31-2010
998	6	0	0,20	7,31	Slaughtered	12-02-2011
997	4	1	-1,40	8,62	Slaughtered	04-08-2011
996	4	1	-0,87	15,47	Slaughtered	04-01-2011
995	0	1	0,00	47,22	Slaughtered	08-07-2009
994	0	1	0,00	47,22	Slaughtered	07-18-2009
993	1	2	-0,79	-6,26	Slaughtered	01-17-2010
992	0	1	0,00	47,22	Slaughtered	07-18-2009
991	0	1	0,00	47,22	Dead/Euthanized	07-09-2009
990	2	0	-1,88	5,83	Slaughtered	04-11-2010
989	3	1	0,28	102,59	Slaughtered	10-31-2010
988	1	1	0,36	128,43	Slaughtered	12-20-2009
987	4	0	0,63	101,15	Slaughtered	02-07-2011
986	1	0	-1,08	45,28	Slaughtered	11-21-2009
985	0	1	0,00	47,22	Slaughtered	07-05-2009
984	5	0	0,00	22,92	Slaughtered	06-10-2011
983	3	0	-1,57	23,73	Slaughtered	10-17-2010

# User interface – culling history

## Culled too early

File Help

Herd Culling Plot Settings

Animals: 4650  
Last updated: 08-27-2018

### Culled Sows

Sow ID

Dates

Value (EUR)  -

Culling type

Parity

---

**Loss due to non-optimal culling**

Culled too early	245086
Dead sows (lost slaughter value)	57079
Culled gilts (incl. dead)	24852
<b>Total loss (EUR)</b>	<b>327017</b>

SoLiv

**Sow ID - 1513**

Internal ID

Culling type

Culling date

---

Parity

Litter history

Inseminations

Last event

---

Potential

Value

Loss

Sow ID	Parity	Litter history	Inseminations	Last event	Potential	Value (EUR)	Culling type	Culling date
1517	5	1				-2,38	Slaughtered	09-14-2012
1515	2	0				-0,94	Slaughtered	02-18-2011
1519	3	0				0,82	Slaughtered	08-28-2011
1514	1	0				0,65	Slaughtered	10-17-2010
1513	1	0			1,23	248,83	Slaughtered	10-03-2010
1511	2	0				-2,05	Slaughtered	02-18-2011
1510	2	1				-0,65	Slaughtered	04-29-2011
1509	2	0				-0,07	Slaughtered	02-18-2011

# User interface – culling history

## Lost slaughter value

File Help

Herd Culling Plot Settings

Animals 4650  
Last updated: 08-27-2018

### Culled Sows

Sow ID

Dates From  To

Value (EUR) From  To

Culling type

Parity

---

**Loss due to non-optimal culling**

Culled too early	245086
Dead sows (lost slaughter value)	57079
Culled gilts (incl. dead)	24852
<b>Total loss (EUR)</b>	<b>327017</b>

SoLiv

Sow ID - 1520

Internal ID

Culling type

Culling date

---

Parity

Litter history

Inseminations

Last event

---

Potential

Value

Lost slaughter value

Sow ID	Value (EUR)	Culling type	Culling date
1517	-0,30	Slaughtered	08-12-2011
1515	-1,13	Slaughtered	10-06-2013
1519	-1,41	Slaughtered	04-01-2011
1514	-1,65	Slaughtered	12-09-2012
1513	0,94	Slaughtered	11-07-2010
1511	-2,23	Slaughtered	10-10-2010
1510	-1,58	Slaughtered	03-18-2011
1509	0,36	Dead/Euthanized	11-15-2010
1508	-2,52	Slaughtered	10-17-2010
1507	-0,12	Slaughtered	01-06-2013
1506	-0,21	Slaughtered	11-07-2010
1505	-1,96	Slaughtered	03-18-2011
1504	-0,47	Slaughtered	11-26-2012
1503	1,81	Slaughtered	10-07-2011
1502	0,40	Slaughtered	03-18-2011
1501	-0,50	Dead/Euthanized	11-16-2010
1500	-2,38	Slaughtered	09-14-2012
1499	-0,94	Slaughtered	02-18-2011
1498	0,82	Slaughtered	08-28-2011
1497	0,65	Slaughtered	10-17-2010
1496	1,23	Slaughtered	10-03-2010
1495	-2,05	Slaughtered	02-18-2011
1494	-0,65	Slaughtered	04-29-2011
1493	-0,07	Slaughtered	02-18-2011

# Summary

- Software tool based on raw data:
  - Decision support in sow replacement
  - Assessing the culling strategy
  - Monitor progress in various parameters in real-time
- Software freely available at [www.pigit.ku.dk/SoLiv](http://www.pigit.ku.dk/SoLiv)
  - In Danish and English
  - User-defined currency
  - Compatible with
    - AgroSoft WinPig (.NET version)
    - Cloudfarms
    - Demo is available

# Summary

- Financed by



and

Promilleafgiftsfonden  
(Production levy foundation)

- Bibliography

[1]

Kristensen, A.R. & T.A. Søllested. 2004. A sow replacement model using Bayesian updating in a three-level hierarchic Markov process. I. Biological model. *Livestock Production Science* 87, 13-24.

Kristensen, A.R. & T.A. Søllested. 2004. A sow replacement model using Bayesian updating in a three-level hierarchic Markov process II. Optimization model. *Livestock Production Science* 87, 25-36

Rodríguez, S.V., T.B. Jensen, L.M. Plà & A.R. Kristensen. 2011. Optimal replacement policies and economic value of clinical observations in sow herds. *Livestock Science* 138, 207-219.

[2]

Claudio Bono, Cecile Cornou, Kristensen A.R. 2012. Dynamic production monitoring in pig herds I: Modeling and monitoring litter size at herd and sow level. *Livestock Science* 149, 289-300.

Claudio Bono, Cecile Cornou, Søren Lundbye-Christensen, Kristensen A.R. 2013. Dynamic production monitoring in pig herds II: Modeling and monitoring farrowing rate at herd level. *Livestock Science* 155, 92-102.

Claudio Bono, Cecile Cornou, Kristensen A.R. 2014. Dynamic production monitoring in pig herds III: Modeling and monitoring mortality rate at herd level. *Livestock Science* 168, 128-138.



Want to hear more about our studies?

**PigIT closing conference** – 13.11.2018, Copenhagen

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