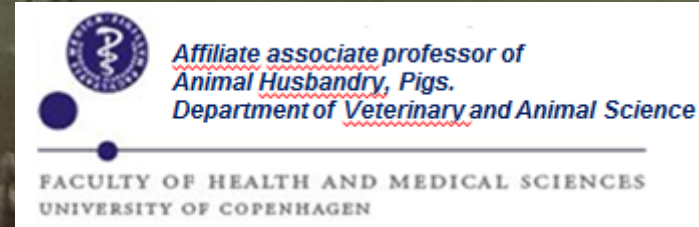


Loose housed sows

Chief Scientist

Vivi Aarestrup Moustsen, Ph.D., M.Sc.

23rd August 2023



Danish Pig Levy Fund **SEGES**
INNOVATION

Hyper-prolific high performance sows

- We 'want' sows
 - Capable of nursing piglets
 - Low input – work
 - Low input medication
 - Long and large life performance
- We expect them
 - To have uncomplicated farrowing
 - But it is a marathon – a farrowing takes 4-8 hours
 - To produce significant amounts of milk continuously
 - 16 kg/day on average
 - To release many fertile eggs



I just gave birth to 25 liveborn piglets – took 8 hours



I'm producing 16 liter of milk every day



I'm carrying 18-32 fetuses

Expectations and conditions

- High expectations regarding the sows' performance
 - Must provide conditions for them to be able to meet our expectations
 - Housing
 - Nutrition
 - Management
 -
- PROP 12 – win-win-win situation
 - You continue to produce pork
 - Sows welfare standard increases
 - Society acknowledge and supports the industry – or at least parts of society
 - Make your reasoning science based – and transparent



The future is not 'only' welfare - it's a more sustainable pork production



And the global demand for protein is increasing

- Pork is and continues to be important

Environment /
climate impact



Social responsib

- Incl. animal welfare



Business earnings



Critical points

Before investment

- Decision making
- Key decisions

Daily management

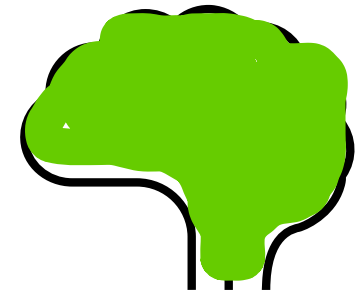
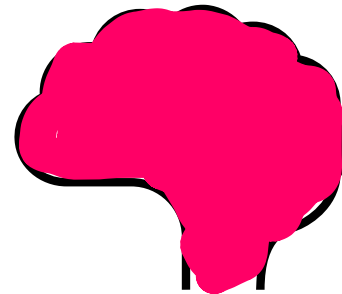
- Calm handling of sows
- Use of confinement



PROP 12 – not ‘just’ 2.23 m² – but 2.23 m² that increase productivity

Behaviours – when, what, why, how....., all at a time or....., group size, age,...

- Space allowance
- Feed
- Drink
- Dung
- Rest
- Grouping
- Estrus
- Turn (PROP12)
- Thermoregulation
-



Frustrating? or fortunate?

PROP 12 vs. EU and DK-legislation (1) (non-lactating sows)

PROP 12	EU	DK		
24 square feet of usable floorspace per breeding pig Gestation crates are not permissible = sows must be housed loose 24 square feet = 2.23 m ² (Section 1322.1. Breeding Pig Confinement – page 29)	The total free floor area that are accessible for every gilt after mating and every sow when gilts and/or sows are kept in flocks, must be at least 1.64 m ² and 2.25 m ² , respectively. When the flock is less than six animals then the free floor area should be increased by 10%. When the flock is more than 40 animals then the free floor area should be reduced by 10%.	0-17 sows	2.80 m ² per sow	For the first 4 sows
			2.20 m ² per sow	For the additional 6 sows
			2.00 m ² per sow	For the then additional 7 sows
		18-39 sows	2.25 m ² per sow	
		Over 39 sows	2.025 m ² per sow	
		0-20 gilts	1.90 m ² per gilt	For the first 10 gilts
			1.70 m ² per gilt	For the additional 10 gilts
		Over 20 gilts	1.50 m ² per gilt	For every additional gilt

PROP 12 vs. EU and DK-legislation (2) (non-lactating sows)

PROP 12	EU	Germany	DK	UK
<p>Stand up, lie down, fully extend animal's limbs, turn around freely</p> <p>Turning around freely means turning in a complete curcle without any impediment, including a tether, and without touching the side of an enclosure or another animal</p>	<p>The pen where the group is kept must have sides greater than 2.8 m in length.</p> <p>When fewer than six individuals are kept in a group the pen where the group is kept must have sides greater than 2.4 m in length</p>		No dimension less than 3.0 m	
<p>Can be confined for 3 hours per 24 hours</p> <p>Can be confined for 3 hours per 24 hours</p>		To be decided (No confinement)	<p>Loose housed from weaning until last week before next farrowing</p> <p>Can be confined up to three days during estrus</p>	Can be confined for 4 hours at insemination

You can use European and Danish research results as conditions and legislation here is stricter than PROP 12



Loose housed gestating sows

- Recommendations
 - Individual feeding
 - Stable groups (no mixing) (15-60 sows)
 - Optimized design (functional areas – resting – eating – dunging)
 - Design depends on feeding system (ESF, eating-stalls, wet-feed (liquid feed in trough...))
 - Non-slippery flooring
 - Surveillance
 - Easy to separate sick or injured sows from the group

[Read more: Drægtighedsstald \(svineproduktion.dk\)](https://svineproduktion.dk)

Group-housing after service



- Critical period d 10-25 after service
- Individual feeding otherwise reduced litter size
 - Electronic sow feeding
 - Free access stalls



Electronic sow feeding



- Individual feed ration
- Managed and controlled feed ration
- Large degree of flexibility
- **Competition while waiting for feed**
 - Focus on the gates
 - Focus on feeding curves and strategy
 - Start the feeding “day” in the night

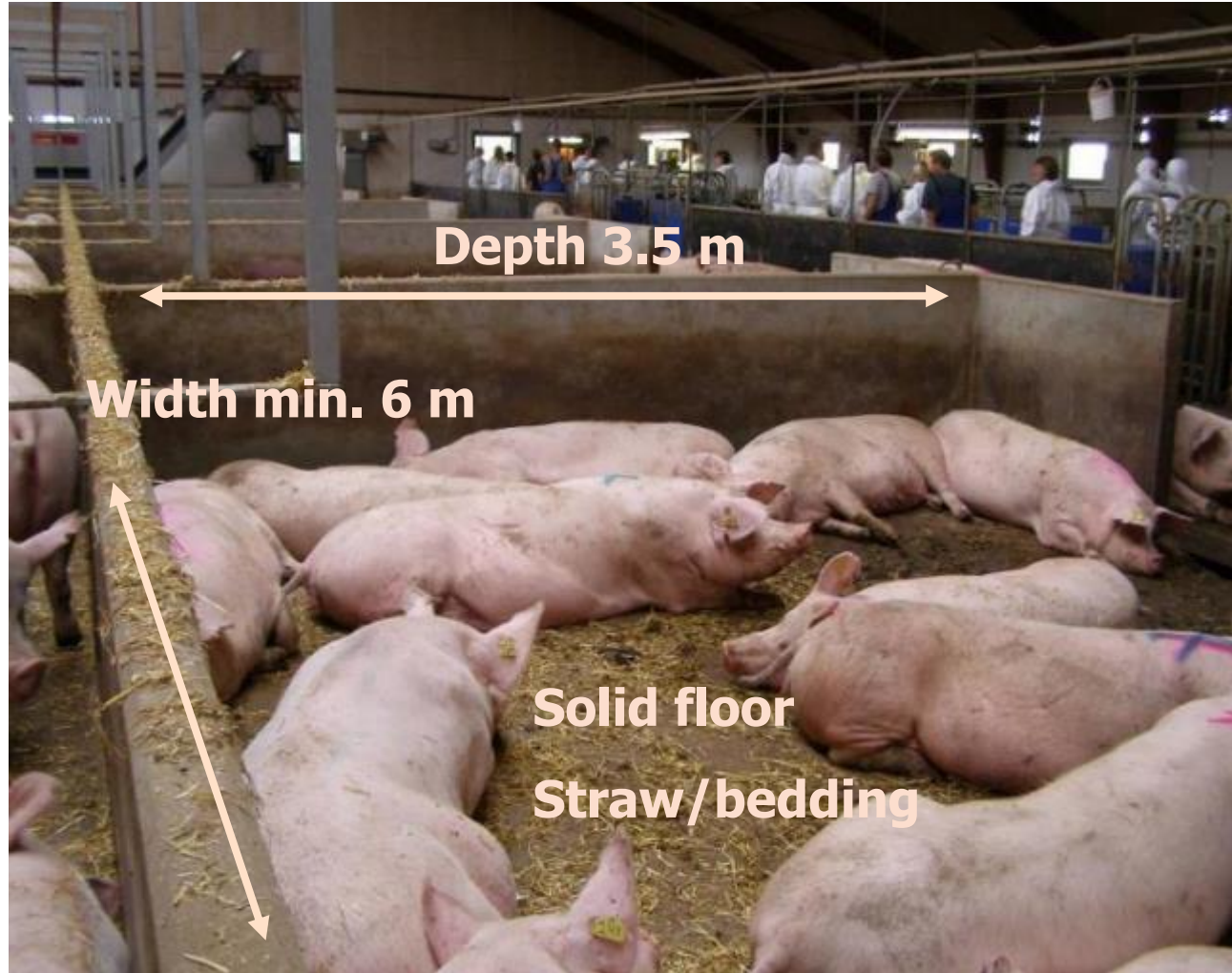


Recommended number of sows per feeding station

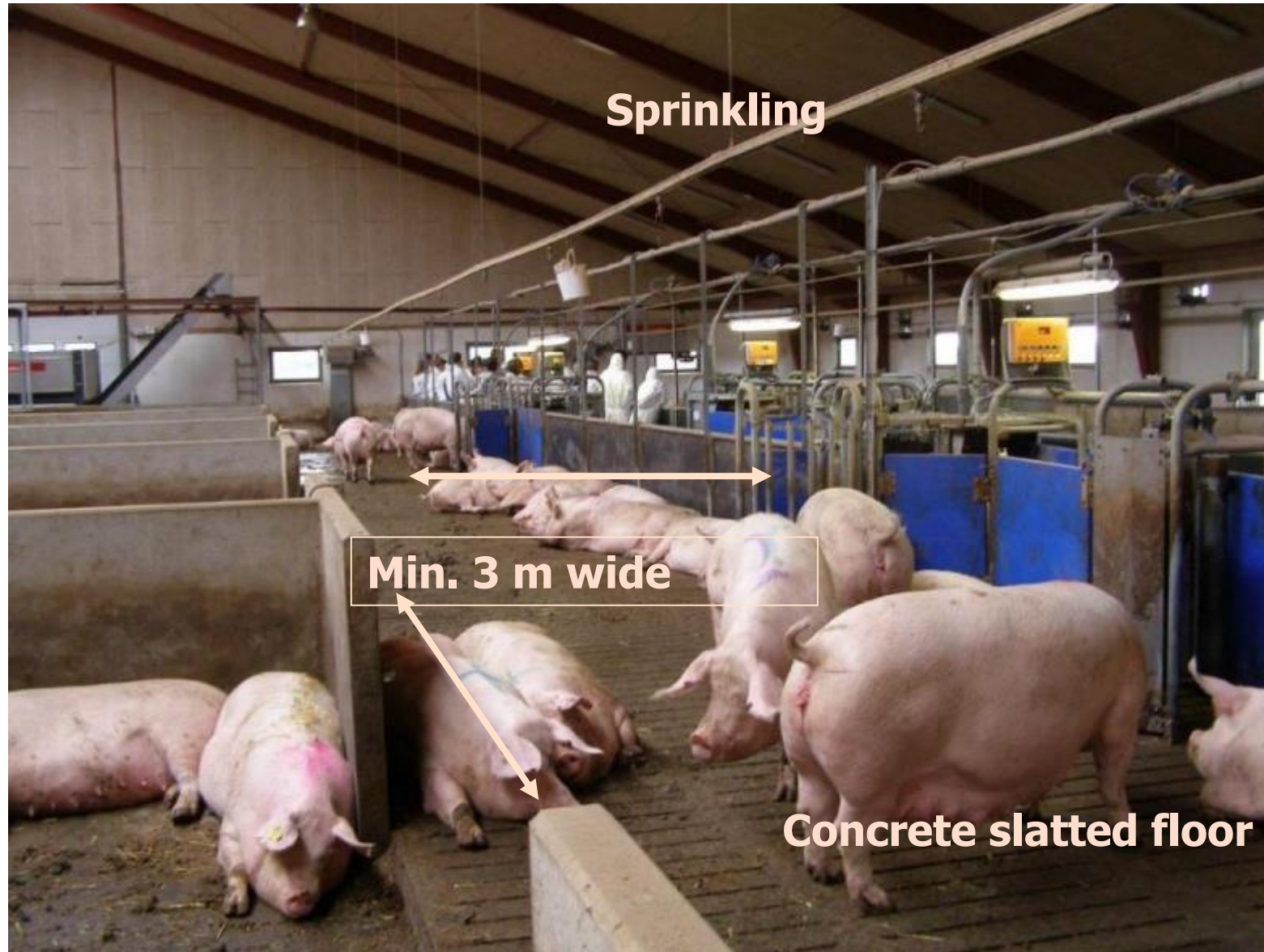
- All sows must eat their daily ration within 14-16 hours
- Gestating sows (one station)
 - 55 sows
- Gestating sows (several stations/pen)
 - 65 sows
- Gilt pen (40-50 gilts)
- Training pen (30 gilts)



Dimension of lying area



Dimension of activity area



Lying behaviour - clean lying area





Training to use ESF

- Young gilts (before service)
- 3-4 weeks
- Training station
- Ear tags
- Left-over list
- Pen designed as the gestation pen



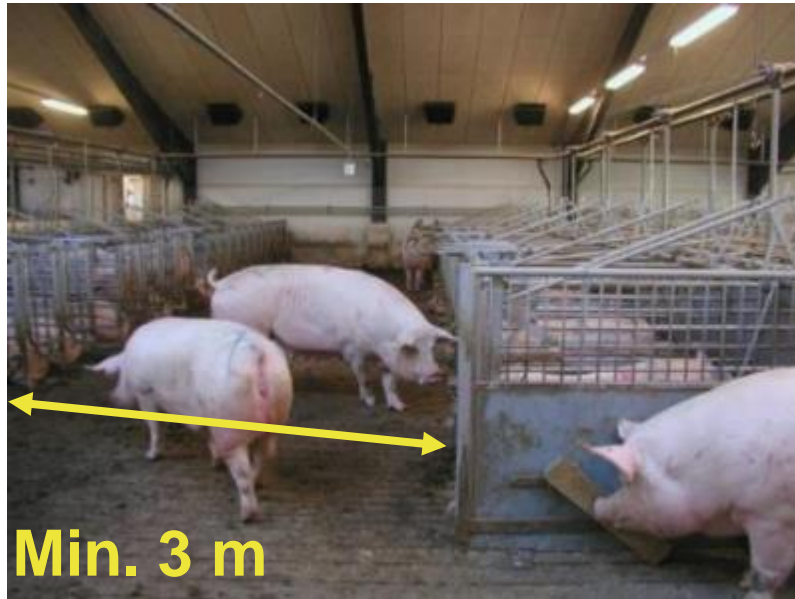
Free access feeding stalls



- Simultaneous feeding
- “Individual feed ration”
- Management and control of feed ration
- Requires a large area



Dimension of activity area



L-pen



T-pen

Group housing 4 weeks after service



- Critical period is over
- Management of condition while sows are in stalls
- Floor feeding and liquid feeding in long troughs also possible

Managing body condition - competition for feed



- Sorting of the batch into four groups:
 - Gilts
 - Thin sows
 - Normal sows
 - Fat sows



Floor feeding



- One daily feeding
- Scatter the feed
 - 1.3 m²/sow
 - Two pipelines
- 0.9 FE/kg
- Meal feed takes longer to eat



Liquid feeding in long troughs



- Min. 55 cm trough space per sow
- Feed must spread quickly
- One daily feeding or two feedings within approx. 15 minutes
- All/both troughs must fill "at the same time"
- Challenge the firms!

Daily inspection essential



Focus on which sows that are eating
But it is difficult to check for leg problems...!

Hospital pens and treatment



5 – 10 pct. hospital place-units
Bedding



Discuss the medical treatment
with the vet
80 pct. of the sows can return
from hospital pen back to
production!

PROP 12 vs. EU and DK-legislation (3) (lactating sows)

PROP 12	EU	Germany	Austria
Sows/gilts may be confined from 5 days before expected farrowing and through to weaning	To be decided upon	One day before and up to four days after farrowing	
No restrictions	To be decided – EFSA recommends 7.8 m ² per sow (or per pen)	6.5 m ² per sow	5.5 m ² per sow
No restrictions	To be decided	sow must be able to turn around unhindered (200 cm)	minimum width of pen: 160 cm

The sow is/will be loose most or all of the time

Farrowing crate
– confined sows



Farrowing pen
– loose sows



Use temporary confinement –
BUT in a pen designed for a
loose sow

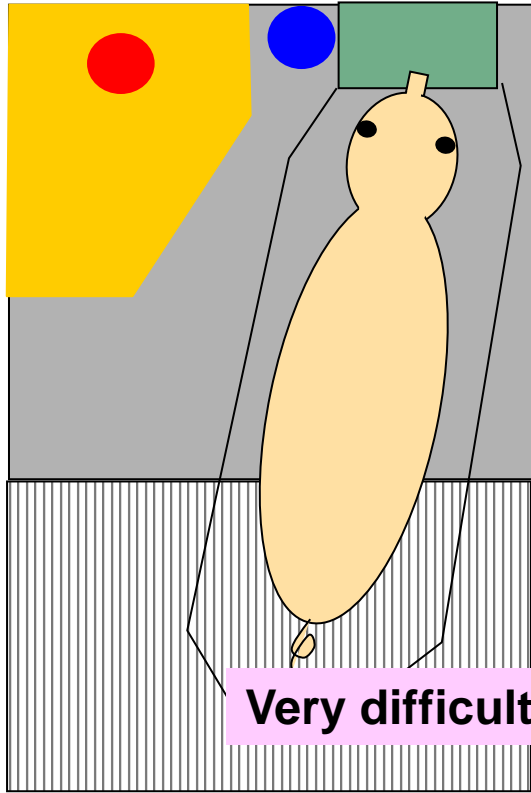
Why can't we just....

- Why not just open up the crate?
 - The sows need more space – they cannot turn around unimpeded in an open crate
 - The sows turn away from feeder (and resting areas) when dunging
- Why not just copy pen designs from Norway, Sweden or Switzerland
 - They use zero-confinement – so 'only' need to design for loose sow
 - Increased litter-size leads to increased need for management in the first few days
 - Use confinement

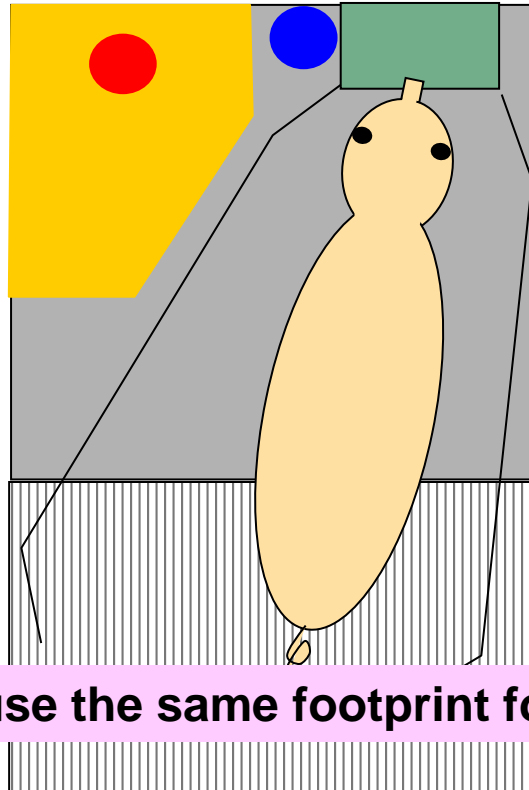
Can we prepare pens with crates?

The answer is 'no'

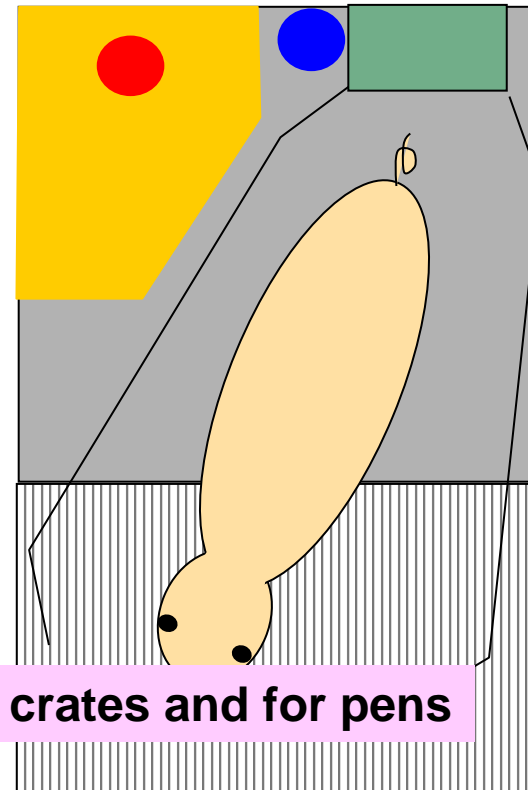
While the crate is **closed**, the sow eats and defaecates in the same position.



When the crates is **open**, the sow continues to eat at the trough.



But turns away from the trough when defaecating.



Very difficult to use the same footprint for crates and for pens

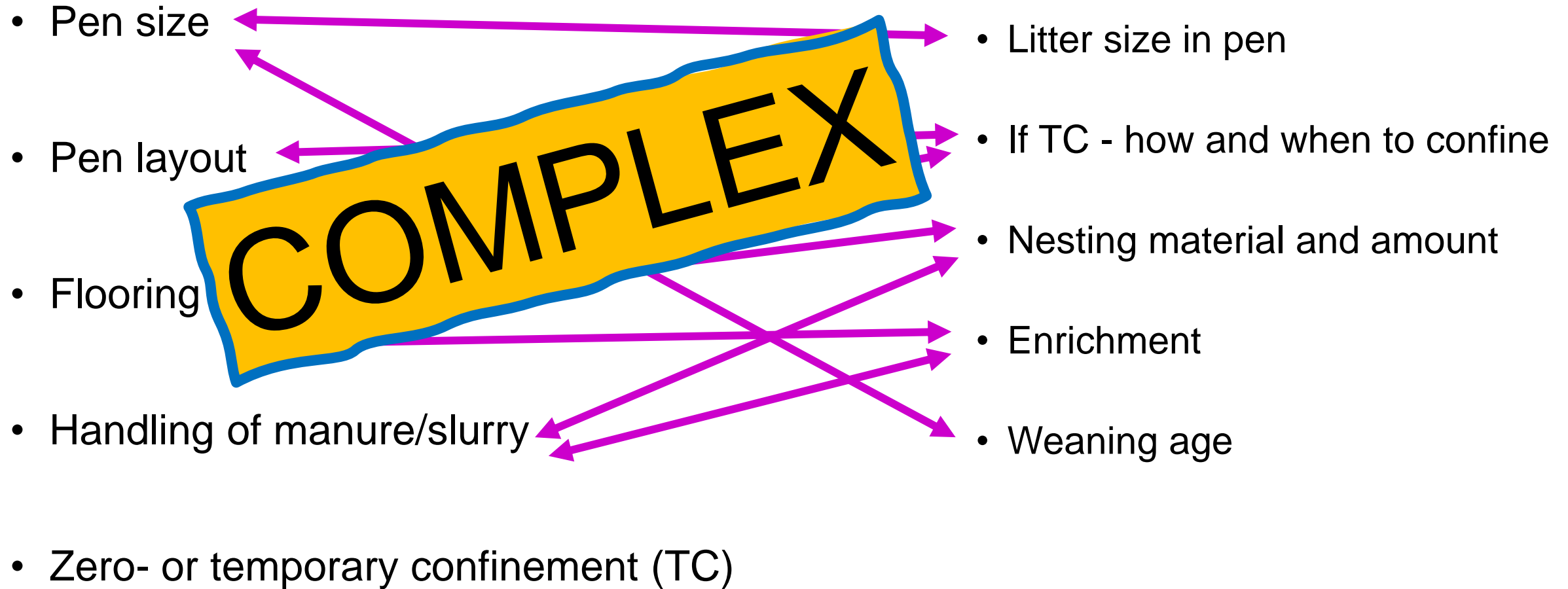
Options or alternatives

- Zero-confinement (free farrowing)
 - Common in countries with legislative enforcement
 - Used in research such as the UMB-pen and PigSAFE
- Temporary confinement (free lactation)
 - Accepted in countries with up-coming legislative enforcement
- Two categories of pens
 - Designed for loose sows – with an option to confine
 - SWAP; ProDromi;
 - Farrowing crate that can be opened



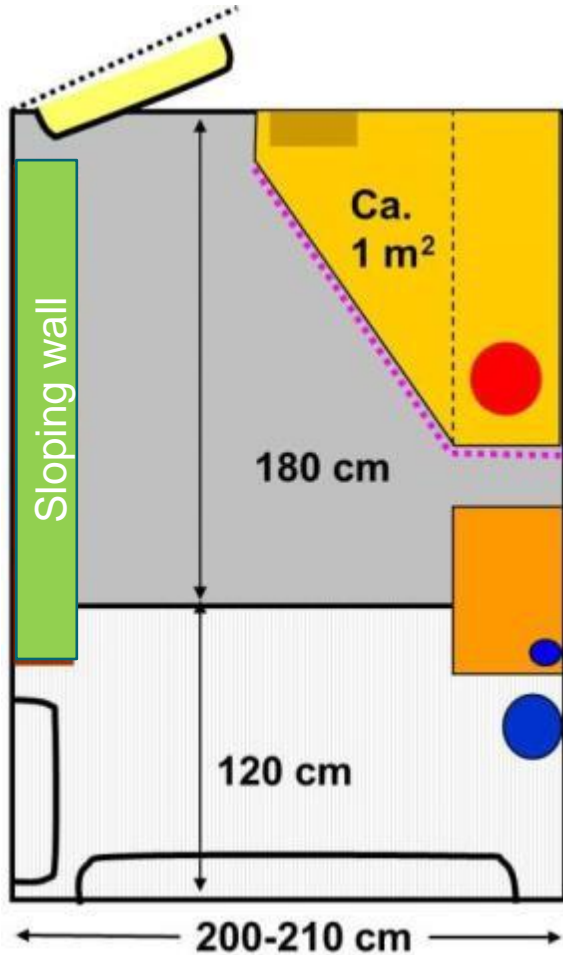
Initial key decisions

Other key decisions



Free farrowing

- Initially - Pen meeting needs of sow, piglet, caretakers



1. Creep area adjacent to the pathway

- Piglets are checked everyday
 - Safety
 - Fast
 - Limit risk of disease transfer

2. Sow-resting area next to creep

- The sows choose to lie next to creep
 - Partly solid floor – at least in Denmark
 - Reduce environmental impact
 - Partly solid floor is cheaper than aircleaners etc
 - Warmth – dry floors before farrowing – and piglet survival
 - Keep nestbuilding- and rooting material in pen – not in slurry

3. The sow walks away (turns away) from feeding area, when defaecating



Piglet survival

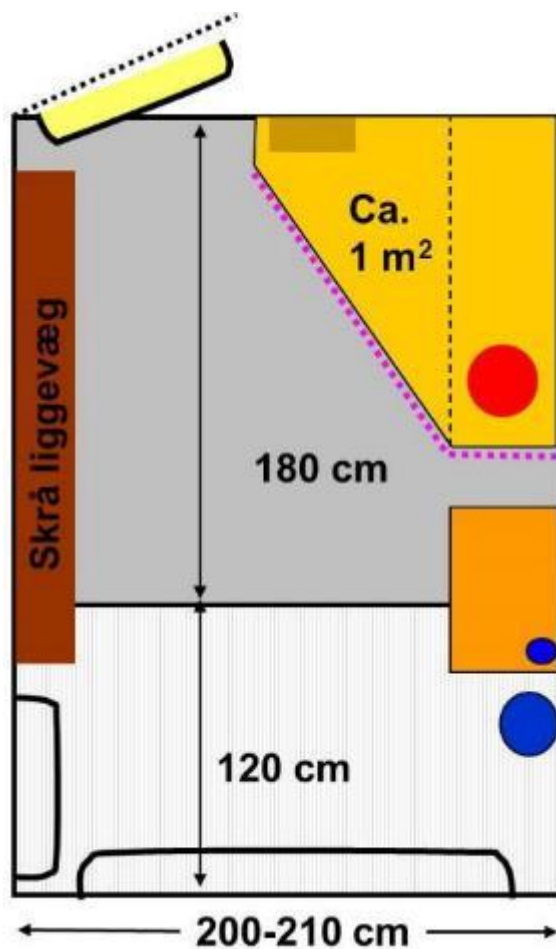
- Sow versus pig welfare
- ‘Killer’ sows
 - ~50% of the loose sows are ‘Killers’
 - ~20% of the sows in crates
- Identification of ‘Killer’ sows
 - Need to find them in time to save the piglets
 - Research-fishing-expedition (5 to 10 years??)
 - How many will we find?
 - Likely intervention = crate (50% of the sows?)



Impact of confinement?

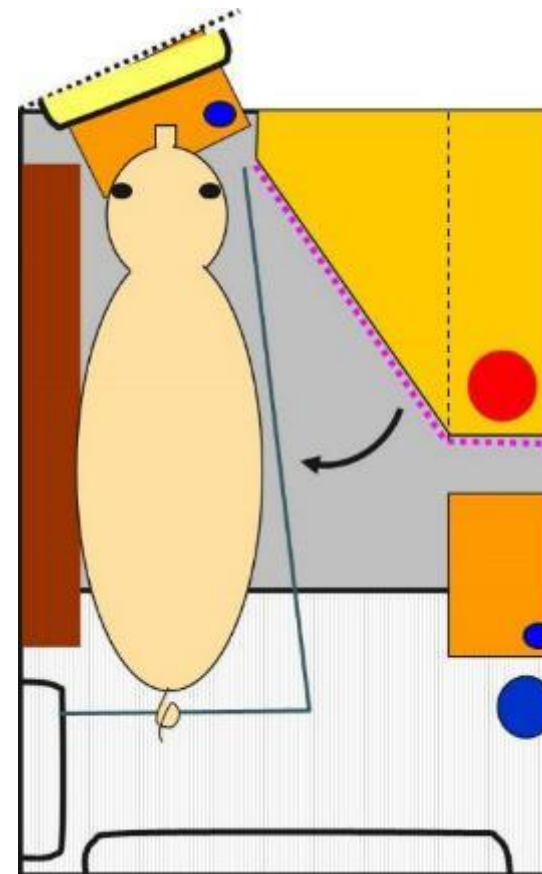
Two pen designs

FF = Free Farrowing



AU/DAWS/PRC +

SWAP = Sow Welfare And Piglet protection



UCPH/PRC



SEGES
INNOVATION

Impact of SWAP on sow movement?

- Before farrowing – nest building period
 - No difference in duration of nest building period
 - No difference in duration of nest building per hour
- After farrowing
 - The sows were lying lateral majority of the time
 - >110 minuts out of 120 minuts observed (4 x daily)

No difference between loose and confined
- in pens designed for loose housed sows



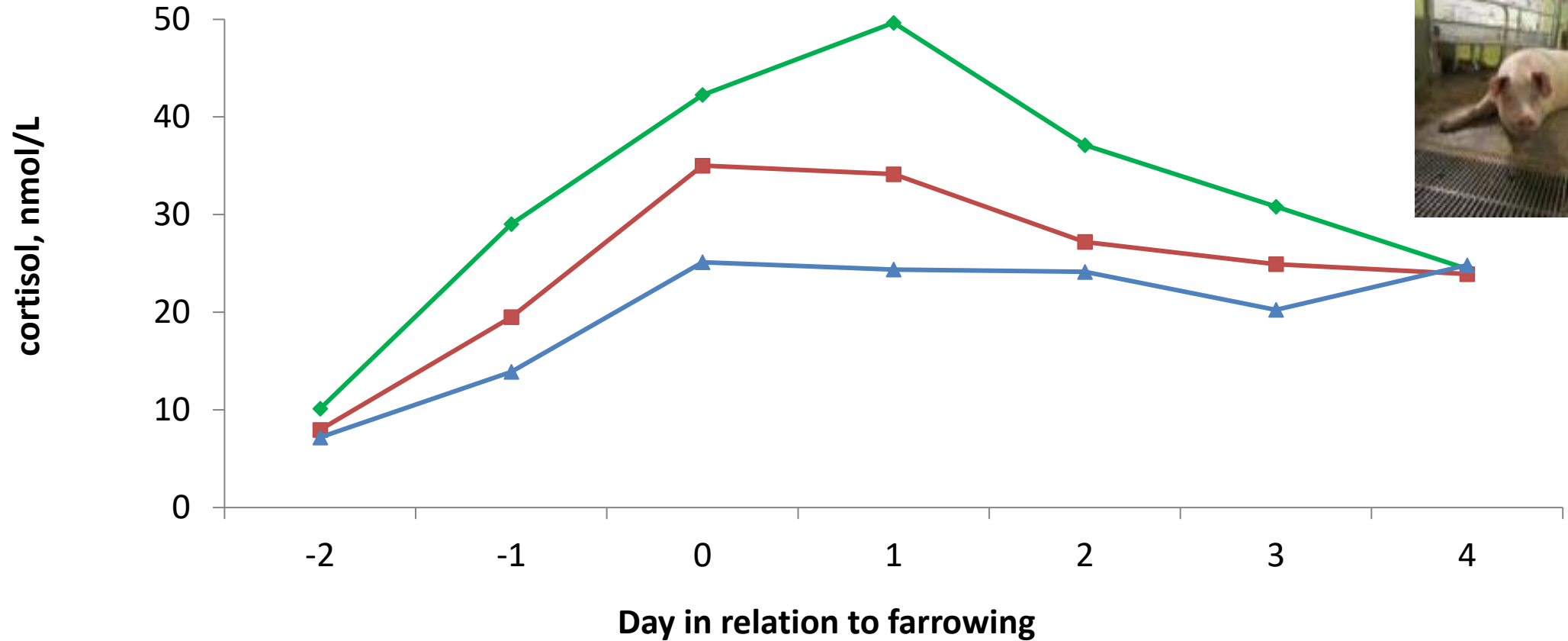
Hales et al., 2014

Cortisol

LC: Loose-Confined: Loose D114 gest until finished farrow then confined day 4 post farrowing

LL: Loose-Loose: Loose D114 gest until day 4 post farrowing

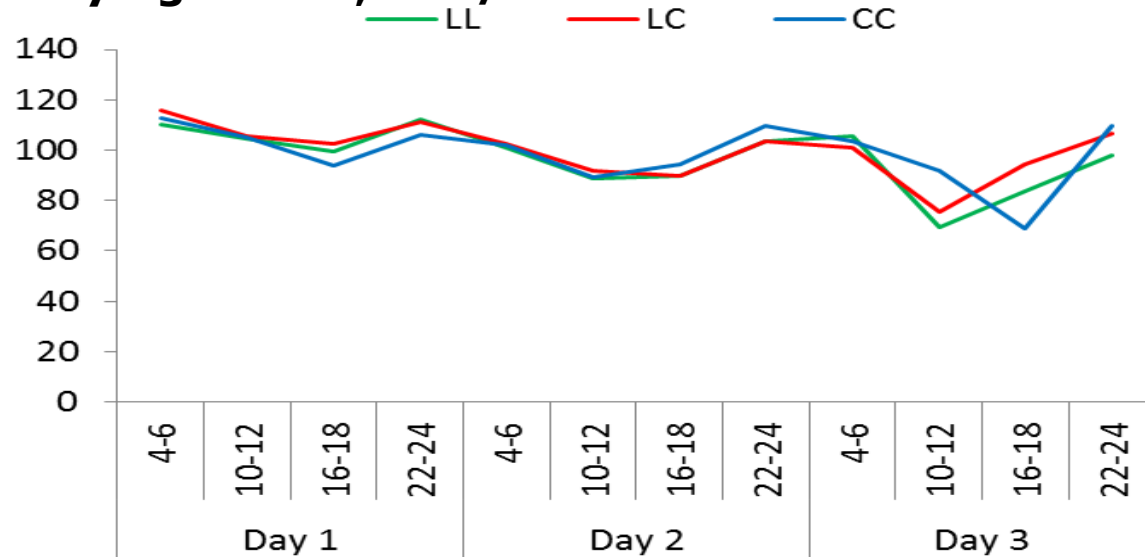
CC: Confined-confined: Confined D114 gest until day 4 post farrowing



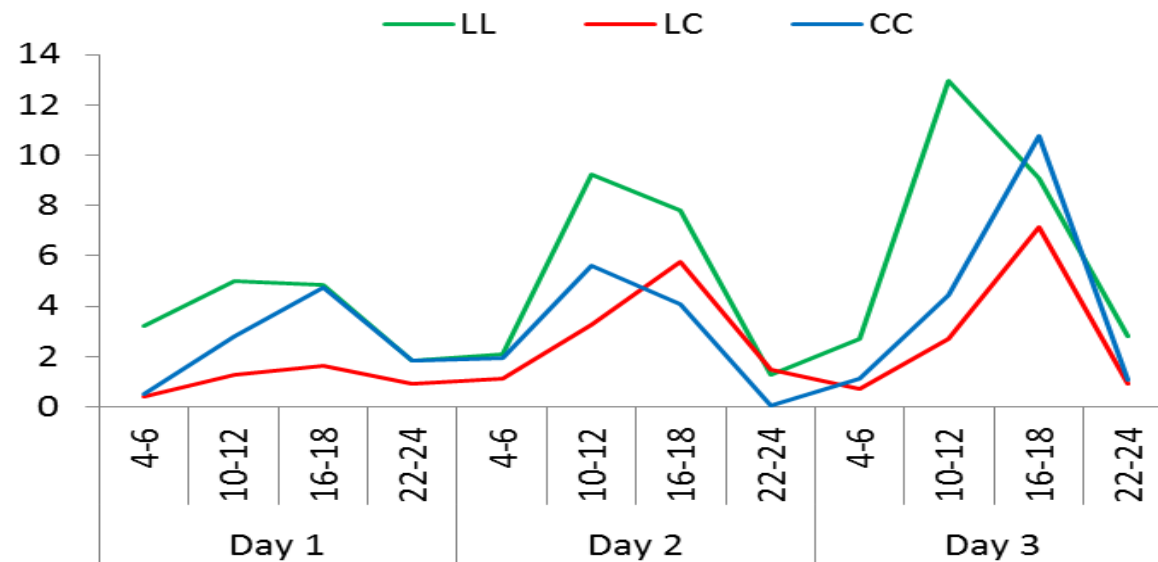
Sows postures



Lying lateral, min/interval

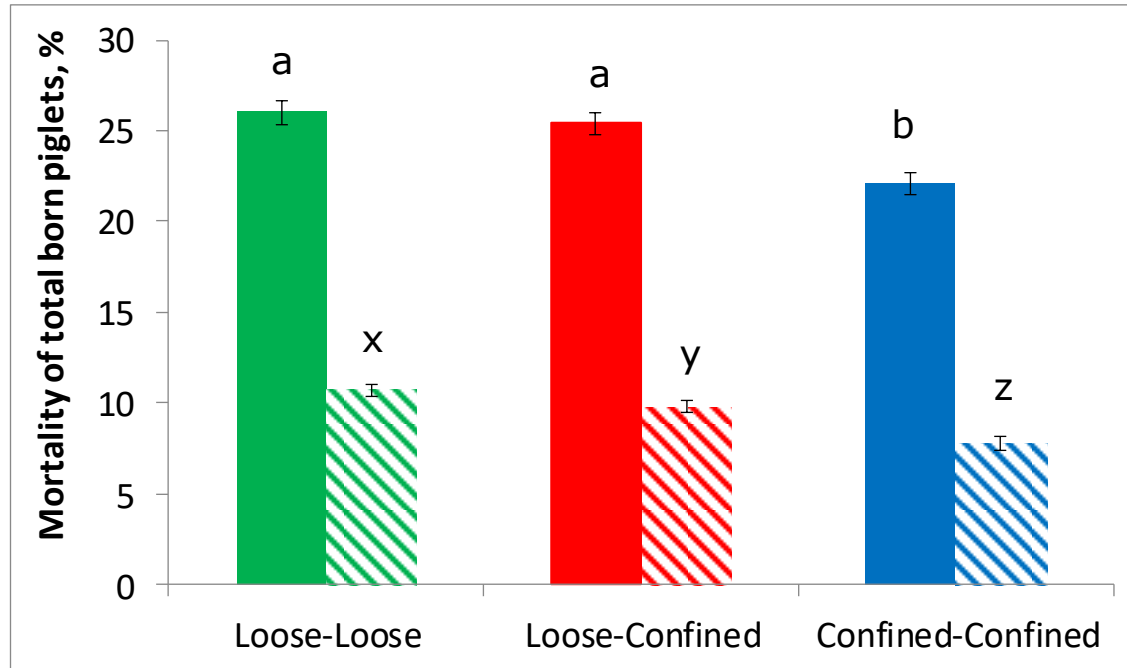
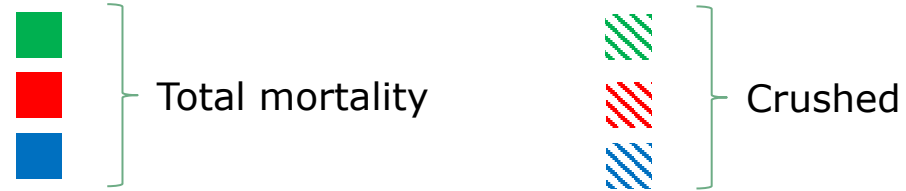


Standing, min/interval



Hales, 2015

Piglet mortality - impact of confinement



Batches: 58 56 59



Hales, 2015

Decisions before building and running afterwards

- Key decisions
- Once you've build – conditions are given - live with it....and optimize within conditions
- Start with successful implementation of higher welfare initiatives
 - Understanding:
 - What do pigs do
 - When do they do it
 - Why do they do it
 - How do they do it
 - ...

Urinate and defaecate



Rest



Socialize



Explore



Nurse



Eat and drink



From animal welfare to sustainability

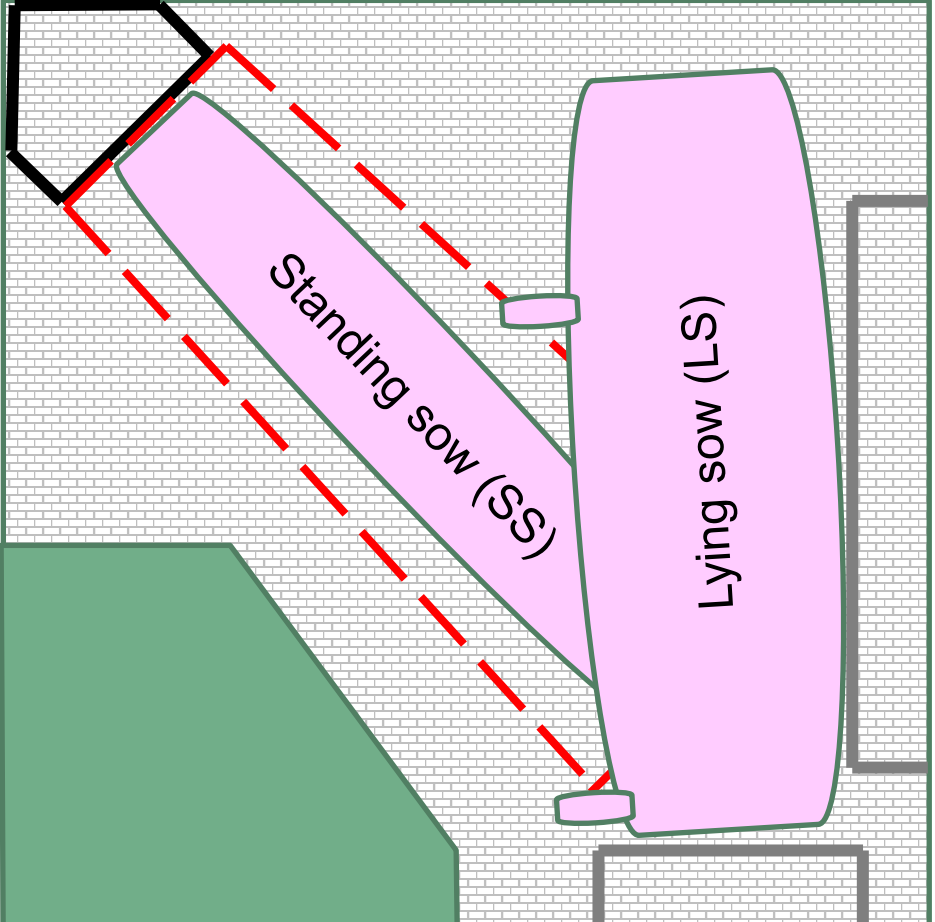
'We' want

- Space
- Cleanliness
- Low input labour
- Healthy piglets

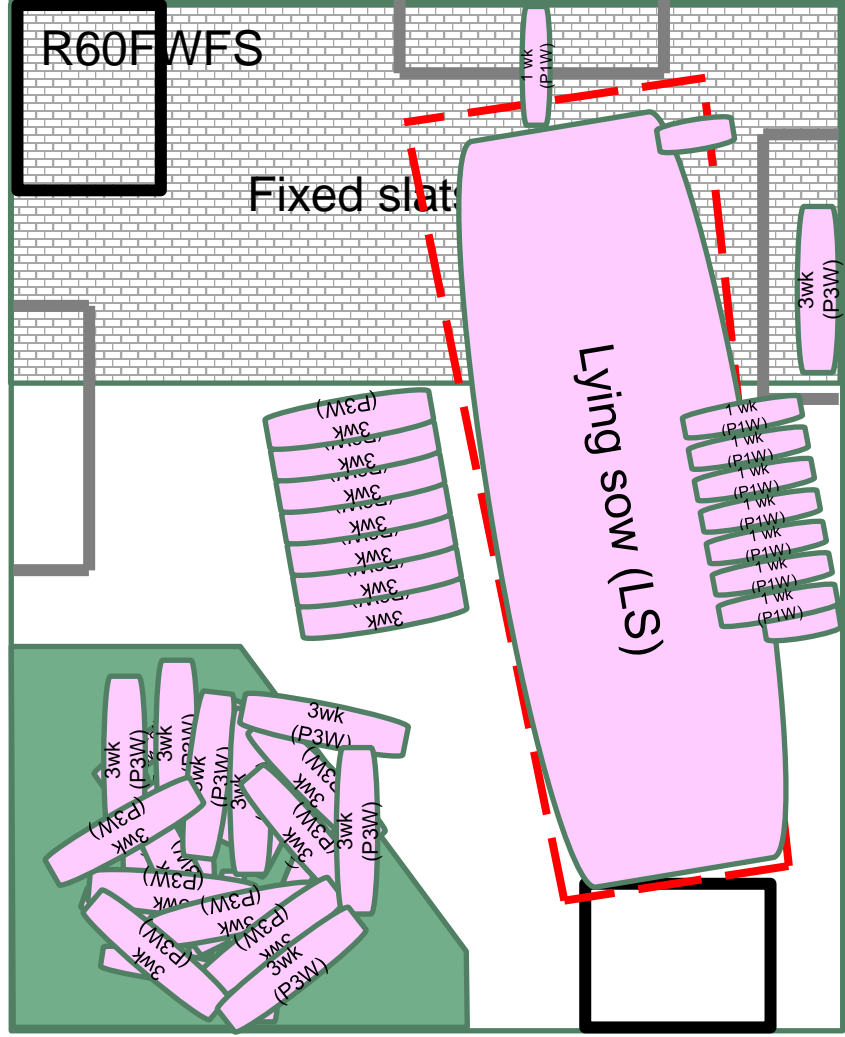
'However:

- Space
 - Larger surfaces - increase emissions
- Cleanliness
 - If slatted floor – increase emissions
- Low input labour
 - If slatted floor – increase emissions
- Healthy piglets
 - If slatted floor – increase emissions

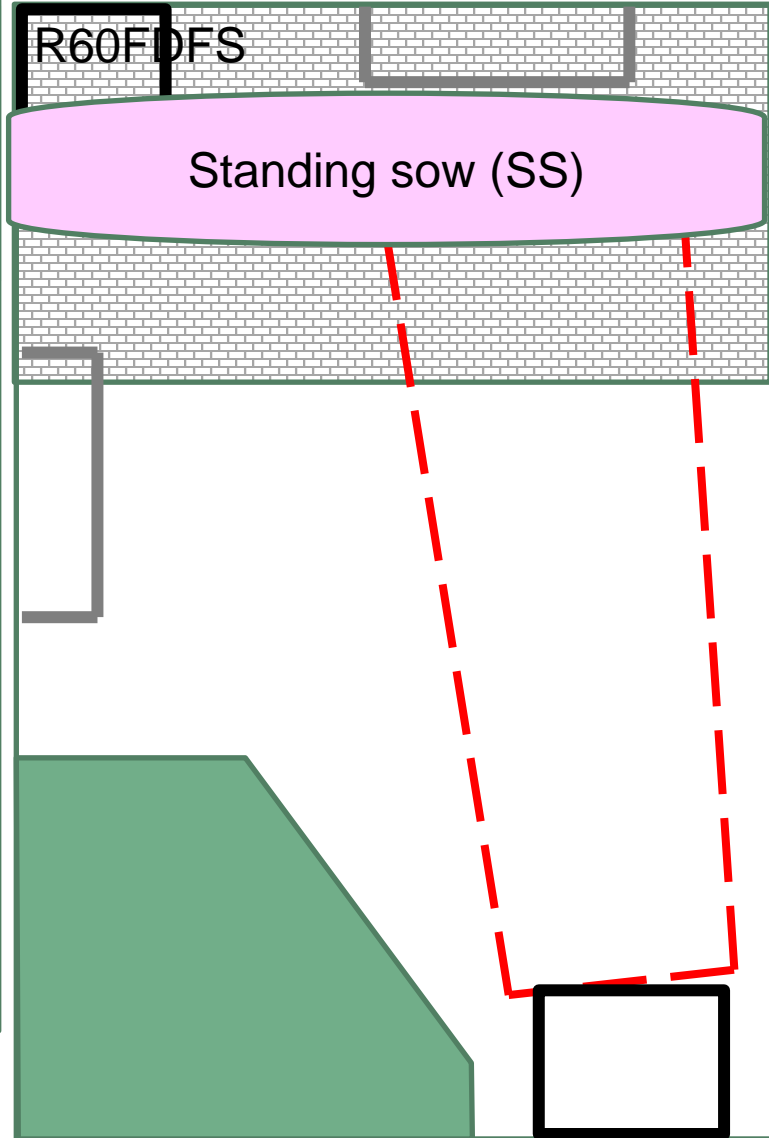
How different can 6 m²-pens be?



Square
S60 / 245*245



Rectangular – width (220 cm)
273*220



Rectangular – depth (300 cm)
300*200

'Ideal' pen size (1)

- Sows' dimensions



Nielsen et al., 2018

- Planar width – turning space



*Planar width of 153 cm
Planar area of 3.17 m²*

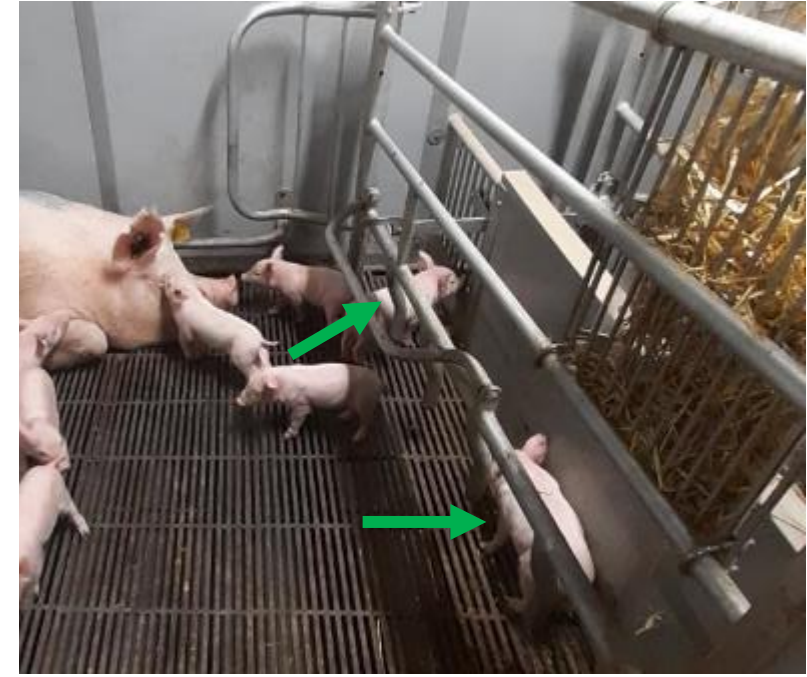
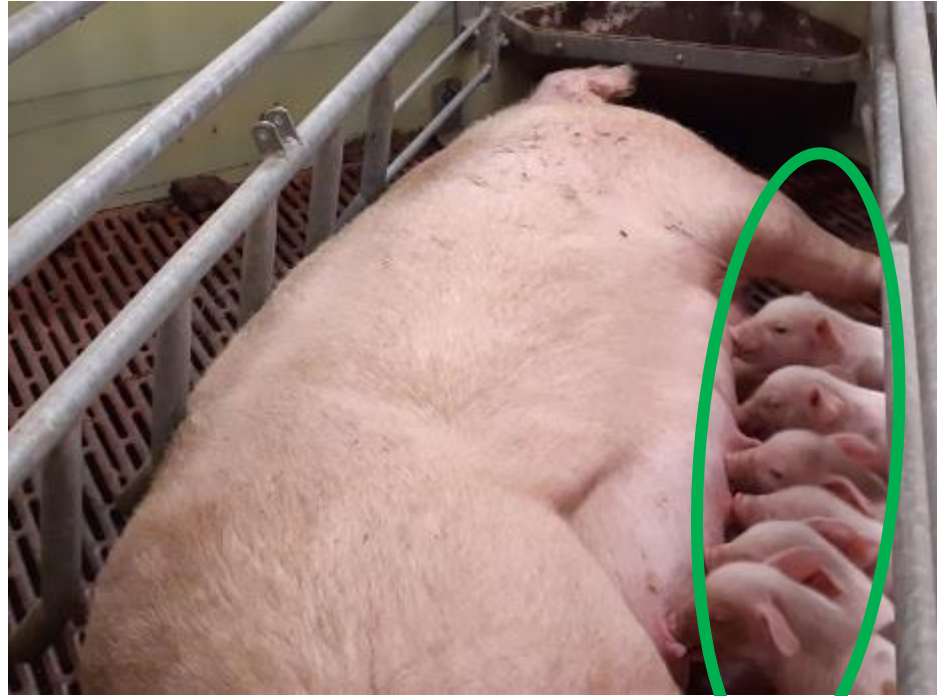
considered necessary to allow unobstructed turning for sows with the 95-percentile weight.

Needs further research

'Ideal' pen size (2)

- Dimensions*number
- Piglet dimensions
 - Birth,
 - One week
 - Four-five weeks
- Litter size in pen

- Functional areas
- Piglet safety zones



Pen layout (1)

- First decision regarding design
- Creep area along passageway
 - Safety
 - Efficiency
 - Reduce risk of transferring diseases
 - Easy access

[FFL21 : Change experiences by a Danish farmer \(openagrar.de\)](https://openagrar.de)



<https://www.freefarrowing.org/research/references/freedom-in-farrowing-and-lactation-2021-ffl21/>

Overcoming barriers, facilitating change



Virtual Workshop August 12th-13th 2021

As part of the [Free Farrowing series of workshops](#), a virtual event (organized by FLI, SEGES, SRUC and Vetmeduni Vienna) was held over two days.

SEGES
INNOVATION

Confinement

- Temporary confinement – take the best of both loose and confined
 - Loose – natural behaviour, access to udder,
 - Confined – lower piglet mortality, safe work conditions
- Before farrowing - loose
 - No piglets at risk, active nest seeking and nestbuilding
 - Quiet/calm the last couple of hours
- During farrowing - confined
 - Ensure access to udder when confined
 - Recent review
 - ‘Lower’ mortality with TC than FF
 - ‘Higher’ mortality with TC than permanent C
- After a few days – loose again
 - Awareness when opening

Ref:

<https://doi.org/10.3389/fvets.2022.811810>

Critical points

- Investment
 - Design for a loose sow
 - Acknowledge key decisions and complexity
 - Ensure space for piglets
 - Include three pillars of sustainability
- Daily management
 - Calm handling
 - Optimize
 - Mindset



Future

- Reflections
 - German legislation
 - End the Cage Age Initiative
 - EU?
- Challenges
 - Sustainability
 - Competitiveness
- Opportunities
 - Increased milk production
 - Large litters
 - Licence to produce



Housing of hyper-prolific high performance sows



I just gave birth to 25 liveborn piglets – took 8 hours



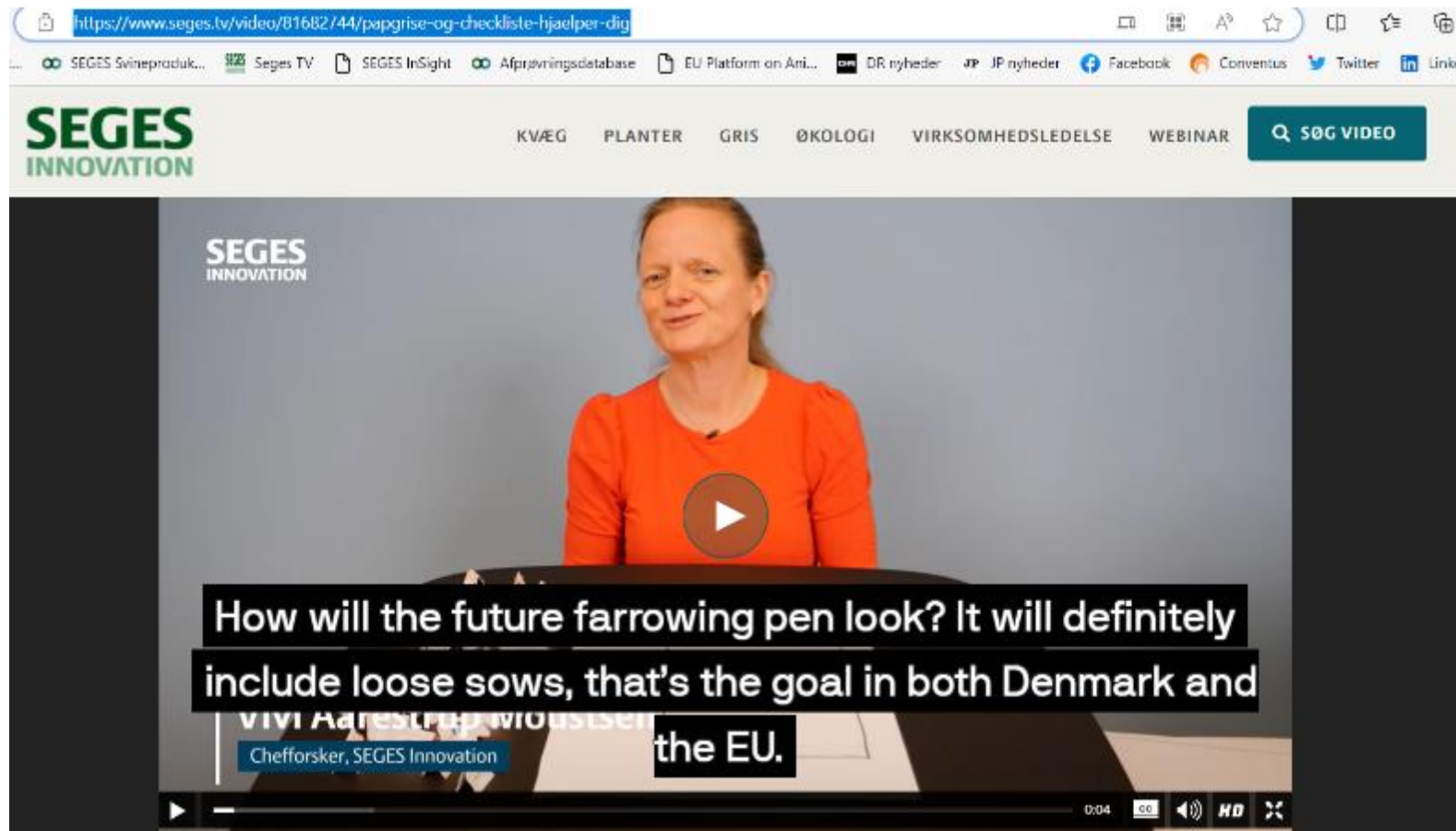
I'm carrying 18-32 fetuses



I'm producing 16 liter of milk every day

Video – with English subtitles

- [Papgrise og checkliste hjælper dig til bedre staldindretning - SEGES TV](https://www.seges.tv/video/81682/44/papgrise-og-checkliste-hjaelper-dig-til-bedre-staldindretning)



The screenshot shows a web browser displaying a video player on the SEGES TV website. The browser's address bar shows the URL: <https://www.seges.tv/video/81682/44/papgrise-og-checkliste-hjaelper-dig>. The website header includes the SEGES INNOVATION logo and navigation links for KVÆG, PLANTER, GRIS, ØKOLOGI, VIRKSOMHEDSLEDELSE, and WEBINAR. A search bar labeled 'SØG VIDEO' is also present. The video player shows a woman in an orange shirt speaking. The video player interface includes a play button, a progress bar, and a volume icon. The video player has a dark overlay with white text that reads: "How will the future farrowing pen look? It will definitely include loose sows, that's the goal in both Denmark and the EU." Below this text, the name "VIVI Aarestrup Wiulstener" and her title "Chefforsker, SEGES Innovation" are visible. The video player also shows a timestamp of 0:04 and a "HD" icon.

More information can be found in eg:

Review of Temporary Crating of Farrowing and Lactating Sows

Sébastien Goumon^{1*}, Gudrun Illmann^{2,3}, Vivi A. Moustsen⁴, Emma M. Baxter⁵ and Sandra A. Edwards⁶

¹Animal Physiology, Institute of Agricultural Sciences, ETH Zürich, Zürich, Switzerland, ²Department of Ethology, Institute of Animal Science, Prague, Czechia, ³Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Prague, Czechia, ⁴SEGES Danish Pig Research Centre, Copenhagen, Denmark, ⁵Animal Behaviour and Welfare, Animal and Veterinary Sciences Group, Scotland's Rural College, Edinburgh, United Kingdom, ⁶School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom

Journal Pre-proofs

Animal board invited review: The need to consider emissions, economics and pig welfare in the transition from farrowing crates to pens with loose lactating sows

V. A. Moustsen^a, Y. M. Seddon^b, M. J. Hansen^c

^aSEGES Innovation P/S, Agro Food Park 15, 8200 Aarhus N, Denmark

^bLarge Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, S7N 5B4, Saskatchewan, Canada

^cDepartment of Biological and Chemical Engineering, Aarhus University, Gustav Wieds Vej 10, 8000 Aarhus, Denmark

Transitioning from crates to free farrowing: A roadmap to navigate key decisions

Emma M. Baxter^{1*}, Vivi A. Moustsen², Sébastien Goumon³, Gudrun Illmann^{4,5} and Sandra A. Edwards⁶

¹Animal Behaviour and Welfare, Animal and Veterinary Sciences Group, Scotland's Rural College, Edinburgh, United Kingdom, ²SEGES Innovation, Aarhus, Denmark, ³ETH Zurich, Animal Physiology, Institute of Agricultural Sciences, Zurich, Switzerland, ⁴Department of Ethology, Institute of Animal Science, Prague, Czechia, ⁵Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Prague, Czechia, ⁶School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom