







Building Our Future – Robotic Milking Systems

Automated Milking System Design considerations

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4dBarn Oy
Jouni Pitkäranta



Boost  Design  Ventilat  Invest 

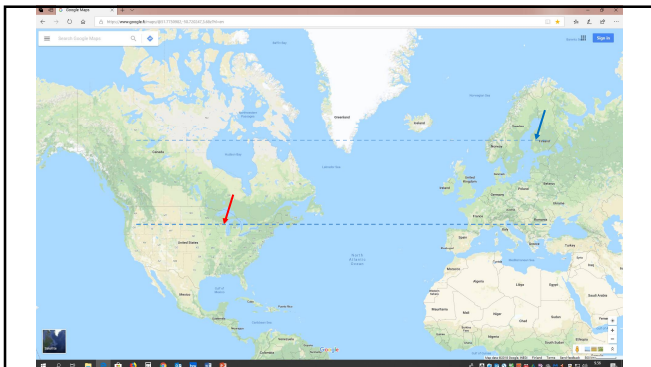
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3d barn + people working with cows = 4dBarn

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My brother´s farm in Finland



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4dBarn Oy Consulting Team

Jouiri Pitkaranta

- Architect (Helsinki University of Technology) 2006
- Own architect office Cowhomes from 1995
- Specialised fully to dairy barn design
- More than 600 designed barns

**Marjo Posio**

- Master in Science in Agriculture, Animal Sciences (Helsinki University in 2010)
- Specialist in calves and young stock, animal welfare, Feeding and Management, LEAN, SOP



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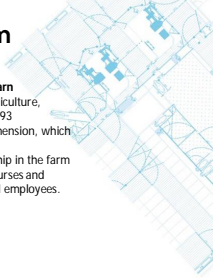
4dBarn Oy Consulting Team

Virpi Kurkela

- DMV, graduated from Faculty of Veterinary Medicine in Helsinki University in 1999.
- focused on health and welfare of dairy cows in robotic milking and heard health management in dairy farms

**Virpi Huotari, CEO of 4dBarn**

- Master in Science in Agriculture, Helsinki University in 1993
- 4th D means fourth dimension, which is a human
- specialities are leadership in the farm and LEAN, human resources and coaching managers and employees.



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4dBarn Oy Consulting Company

- Since January 2016 startup – company 4dBarn has made functional barns designs in Finland, Sweden, Estonia, Russia, USA, Canada 60 - 1500 cows / barn
- There is a significant global interest, because we have over 15 years experience in robotic milking in Finland
- 4dBarn is chosen as a partner of Dairyland Initiative University of Wisconsin Madison USA



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Why AMS or robots?

- Three main reasons to choose robotic milking
 1. Labour
 2. Labour
 3. Labour
- Physically less demanding and more flexible working routines
- More milkings/cow/day
- Lifestyle
- Technical enthusiasm
- Need to expand without extra labour





Photo: Rastinlahti Farm

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A barn is a tool for milk production

- An expensive one with lot of technology
- Main priorities should be:
 - Excellent cow comfort and health -> high milk flow
 - Functionality -> efficient work flow
- Made for use ->
 - Choose the tool for milk production like for any job:
 - The work task you use the tool for and the way you work determines what kind of tool you need
 - Know how to use the tool



Photos: internet

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4BARN® Use the tool in a right way

A tool works well only if you use it in a right way. It is vital, that a milk producer, when using the tool:

- Knows how to use it
 - For example introducing heifers 6 weeks before calving
- Knows the risks and problems, if it is not used "according the manual"
 - E.g. overcrowding

How functional is a tool when usage of it has not been thought through or has no manual?



photo: internet

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How do we determine whether things work or not in AMS barn?

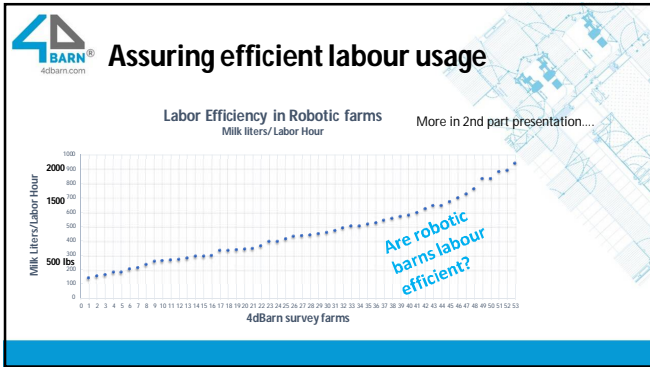
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4BARN® Assuring good cow welfare and health

A barn design elements:

- A comfortable, sand-bedded stall designed for the size of the cow using them.
- Access to food and water - 24 inches (61 cm) of bunk space per cow and 3.5 inches (9 cm) of accessible water trough perimeter per cow.
- Socially-stable groups.
- 12-foot (3.7 m) wide stall alleys, 14-foot (4.3 m) wide feed alleys, and 14-foot wide crossovers between the feed and stall alleys.
- 2- to 3-row pens. If four rows of stalls, two feed bunks will be necessary to achieve sufficient bunk space per cow.
- Sufficient open area in front of the robot(s).
- Functional footbath location.
- Appropriately grooved concrete flooring.
- Training gate for first lactation heifers.
- A designated fresh pen with 24-hour access to the robots.
- Handling area for sick and lame cows.

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A milking robot is just an AMS (Automatic Milking System).

A robot itself doesn't solve any animal welfare, health or labour challenges. It is all about barn design and management around it

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- 4BARN**
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- ### A barn design elements for fluent cow flow and 3 milkings/day
- Stalls
 - Comfortable, sand-bedded, right dimensions
 - Empty alleys -> easy access to the robot
 - Supports hoof health
 - Alleys
 - 12-foot (3.7 m) wide stall alleys, 14-foot (4.3 m) wide feed alleys, and 14-foot wide crossovers
 - Appropriately grooved concrete
 - Easy way to the robot, feed bunk and stalls
 - Gating
 - One person has to be able to do routine work alone safely and quickly
 - Gates make that possible
 - Robot area
 - Sufficient open area in front of the robot(s)
 - Easy access to the robot
 - Access to food and water
 - 24 inches (61 cm) of bunk space per cow
 - 2- to 3-row pens
 - 3.5 inches (9 cm) of accessible water trough perimeter per cow
 - Basis of good milk production
 - No competition/agonistic interaction
 - Cows have a need to eat at the same time also in robotic herds

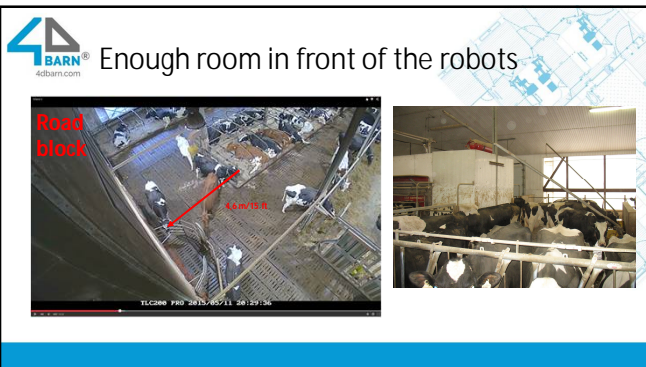
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4BARN® Bunk space
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- Socially-stable groups
 - Low level social stress and agonistic behaviour
 - Easy way to the robot, feed bunk and stalls
- Functional footbath location
 - Lameness prevention and control
 - Crucial for the voluntary cow traffic
- Training gate for heifers
 - First calver is ready to use gates when introduced to the robot
- A designated fresh pen with 24-hour access to the robots
 - Good transitioning to promote production and health
 - Promotes 3 times milking/day
- Handling area for sick and lame cows
 - Easy treatments -> quick recovery back to the main milking group

These will be covered later in the afternoon

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4BARN® A barn design elements for fluent cow flow and 3 milkings/day
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- Right number of cows/robot
 - What is the right number? In 4dBarn data average is 55 cows
 - Risks of having too many cows / robot:
 - Number of fetched cows increases
 - Milk production / cow goes down
 - Cell count goes up
 - Number of visits go down

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Experiences of number of cows in a robot


- A goal is to get cows milked 3x with robots
- Parlour milking x3/day -> robotic milking
 - The challenge is to keep the production level the same
 - Individual cows milking intervals are more uneven than in a parlor, especially if robot capacity is full
- More is not better
 - More cows is often less milk
 - More cows is almost always more work
 - Lots of examples about increased production when adding one extra robot

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Experiences of number of cows in a robot

- Not all the herds are the same
 - Milk flow has quite significant effect to robot capacity
- Technical development of the AMSs
 - Robot attachment speed seems to reach soon a limit (cow is not ready if a robot is)
 - New robot models, how much can we estimate capacity to increase?




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A barn design elements for fluent cow flow and 3 milkings/day

- Management and barn design choices that promote hoof health
 - "Lameness has negative effects on milk production, voluntary milking behavior, and lying behavior of cows in herds with AMS" King et al 2016
→ **Less milk and more work**
 - Lameness prevalence 26-32% in robotic herds King et al. 2016, Enders and Seifer, unpublished



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4BARN® Handling chute

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4BARN® Fresh cow group

- Traditionally for the first 21 days
 - Is that necessary in robotic barns?
 - Technology gives information about the cows: eating, temperature, rumination, activity, BHB, milk yield, somatic cells, milk fat and protein, weight, BCS..... Is that enough?
- VIC-group (Very Important Cows)
 - Small group, less competition
 - Better facilities and management (bunk space, stalls ect)
 - Short distance to the robot, voluntary milking 24/7 -> easy for timid cows/heifers
 - "Under the eye" of a manager

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Deep bedded pack or freestalls with sand


Photo: Raslinlahden tila Facebook

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A barn design elements for fluent cow flow and 3 milkings/day

- Footbath that is practical for the cows to use and people to manage
- Good routing for a handling chute
- Solid, non slippery flooring
- Sand bedding
- Efficient manure handling -> clean hoofs




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The AMS footbath challenge

- Exit lane footbaths decrease robot attendance
- Pushing cows through a footbath on a crossover has never worked well – rodeo!!!




Slide: Dairyland Initiative

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Free traffic or guided traffic?


- Increased milk per cow with free-traffic vs guided (Tremblay et al., 2016)
- In Scandinavia mostly all new robot barns are with free traffic
- Some old guided barns are switched to free traffic
- There are some well working guided barns too



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4BARN® We prefer free cow traffic


- It is a cow comfort perspective!
 - Does the system limit cow performance?
- You still need to fetch cows in the forced traffic
- Not a big difference of amount of pellets given from robot
- Free traffic is easier to manage



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4BARN® Grazing/exercise yard?


- Legislation and/or consumer demands in future
- All new barns should have a grazing possibility at least for some animal groups



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4BARN® So what are the general robot barn design principles

- Very much the same as in conventional milking: promote laying in stalls, eating and excellent animal health and welfare
- Differences:
 - Promote voluntary milking with your design
 - Promote labour efficiency and make a handling of individual cow easy



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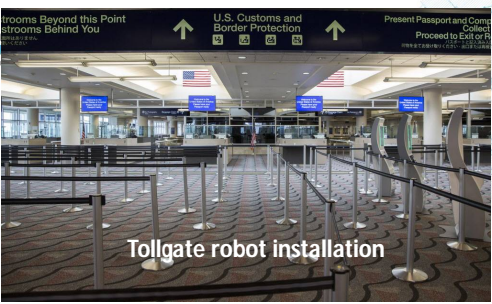
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What have we learned about robot retrofit installations?

- Too often robots just dropped to lay-out
 - It is just enough to get rid of manual milking
 - Location of robots chosen by least construction work and disturb to cows / people during building time
 - "Save now – Pay later"
- With good design functionality can be almost the same as in a new barn
 - To gain it, it needs more changes around the robot
 - But robots in the old barn doesn't solve it's cow comfort issues....

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Tollgate robot installation

Photo source: Startribune

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Pros

- Separates not-milked and milked cows
- Decreases crowding in front of the robot
- Separation can be done even with one separation gate from multiple robots
- Footbath can be easily arranged






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Cons

- Traffic can jam in the exit alley
- Exit alley's end must be protected
- Robot maintenance
- Cows do more turns when exiting
- Based on experience exit area must be one cow wide
 - Prevents cows turning around



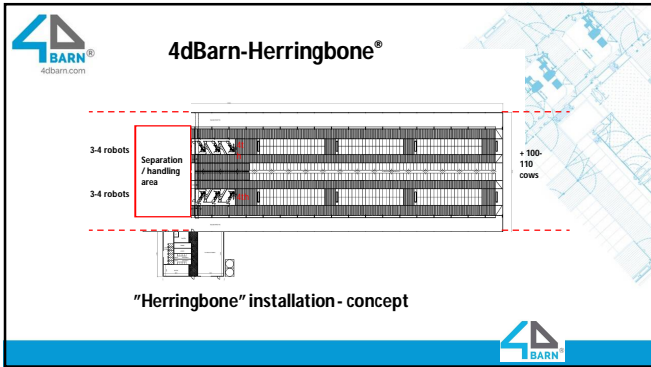
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Clean access to robots over animal lane



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