

Lely's vision in automation and sensor development



ICAR Showcase, Riga, June 2nd 2010

Dr. Tom Vanholder, Lely Industries

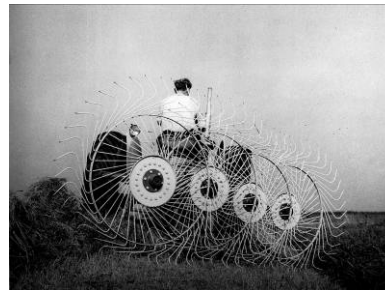
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1948

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Our mission statement

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“To be the company in the dairy and cattle market that is the front runner in state-of-the-art farming solutions, striving for improvement of the financial and social wellbeing of its customers”

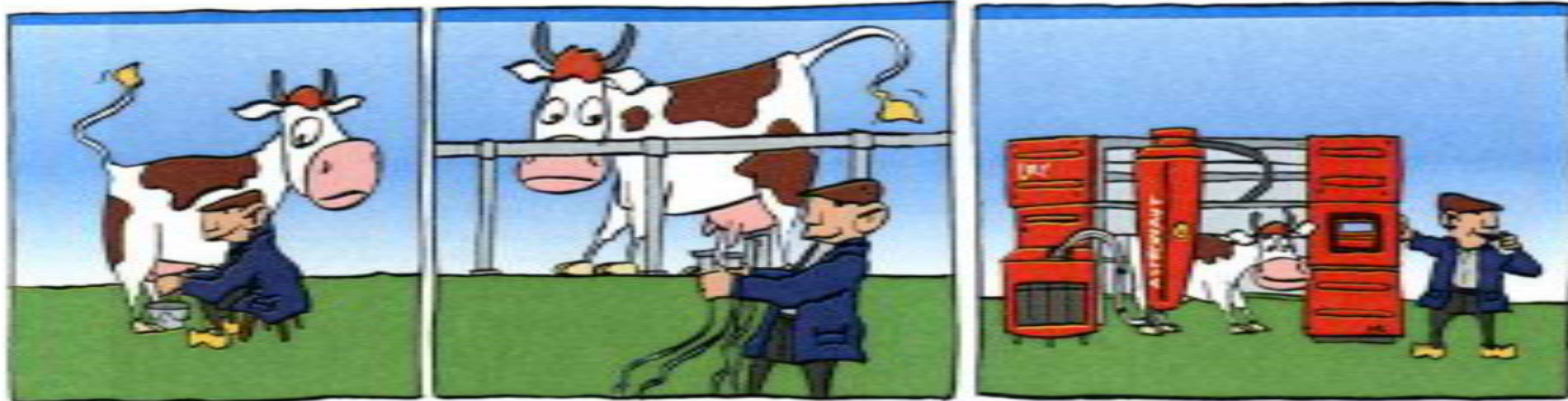




Transition to automation

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Increased farm size – reduced labour force – increased labour costs





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Mechanisation

- Mechanization of routine activities





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Automation

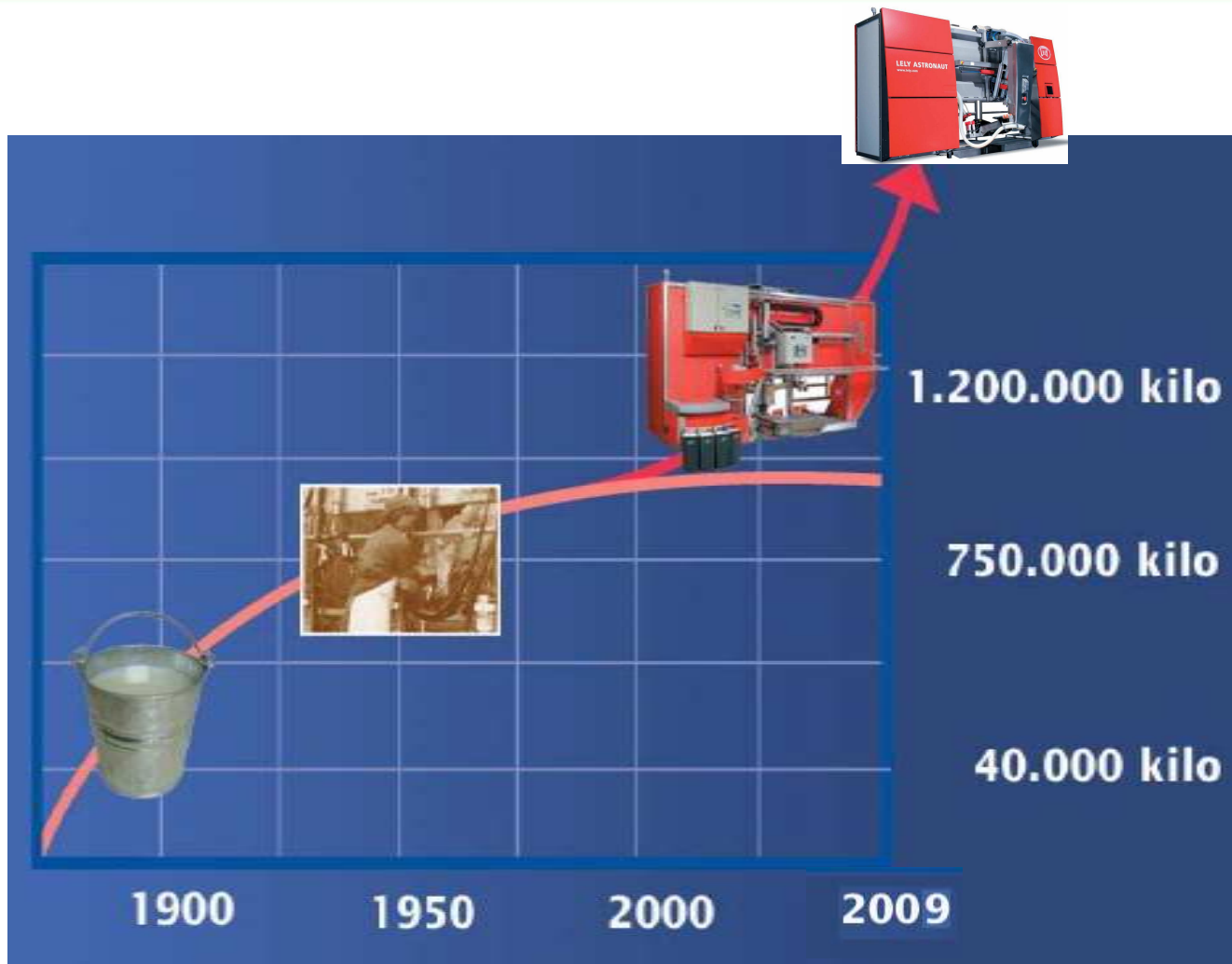
- Automation of routine activities



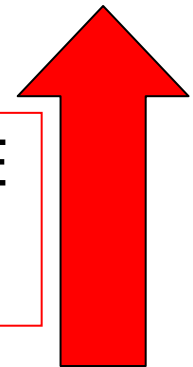


Goals

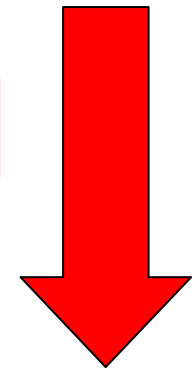
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- Milk/FTE
- Profits



- Costs





More milk/FTE – increase profitability

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Focus on the individual cow:

- Increase individual cow performance and production
- Optimise profits per cow
- **Management by exception**



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smell

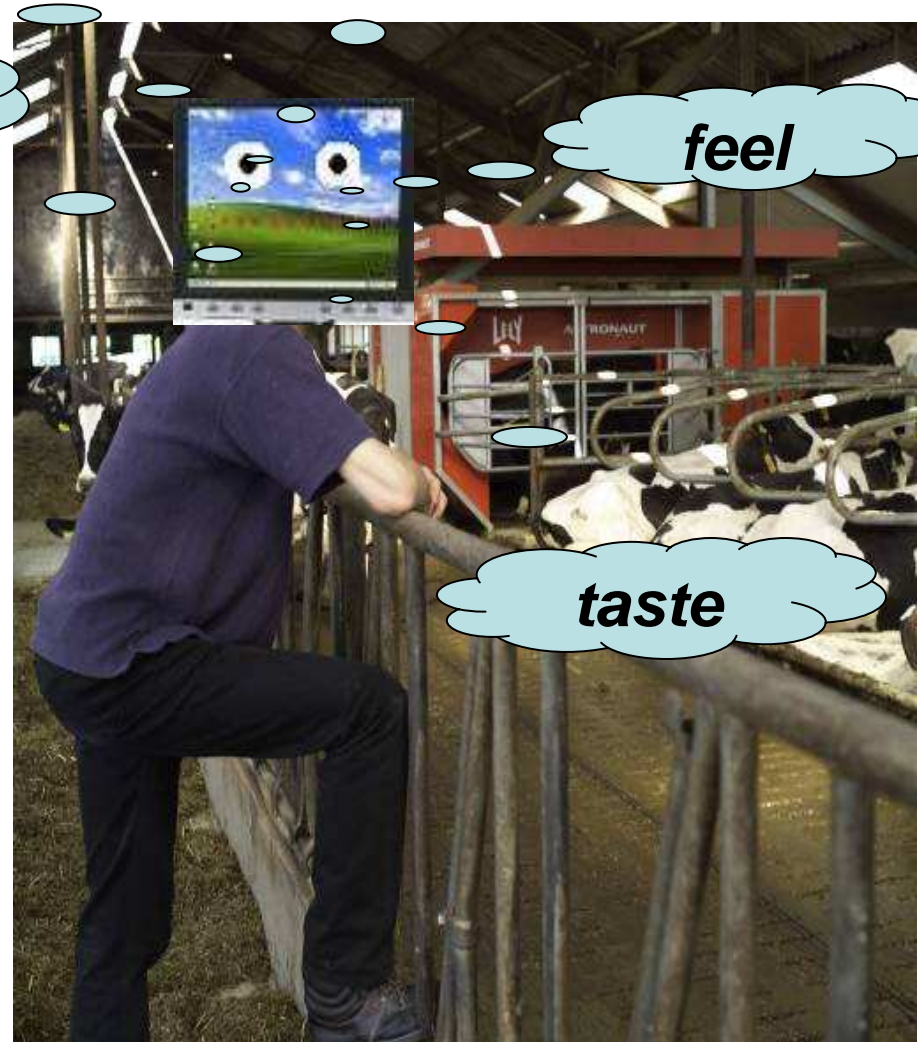
vision

hearing

feel

**How to automate
human senses?**

taste





Automation of human senses

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THE ANIMAL

Who are you ? **(ID)**

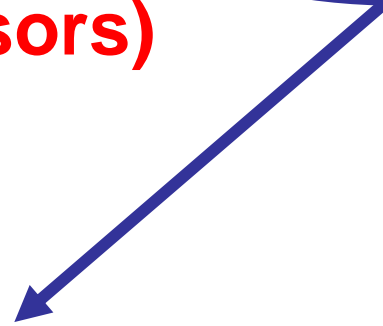


What do you do ? **(sensors)**



What can be improved ? **(software analyses)**

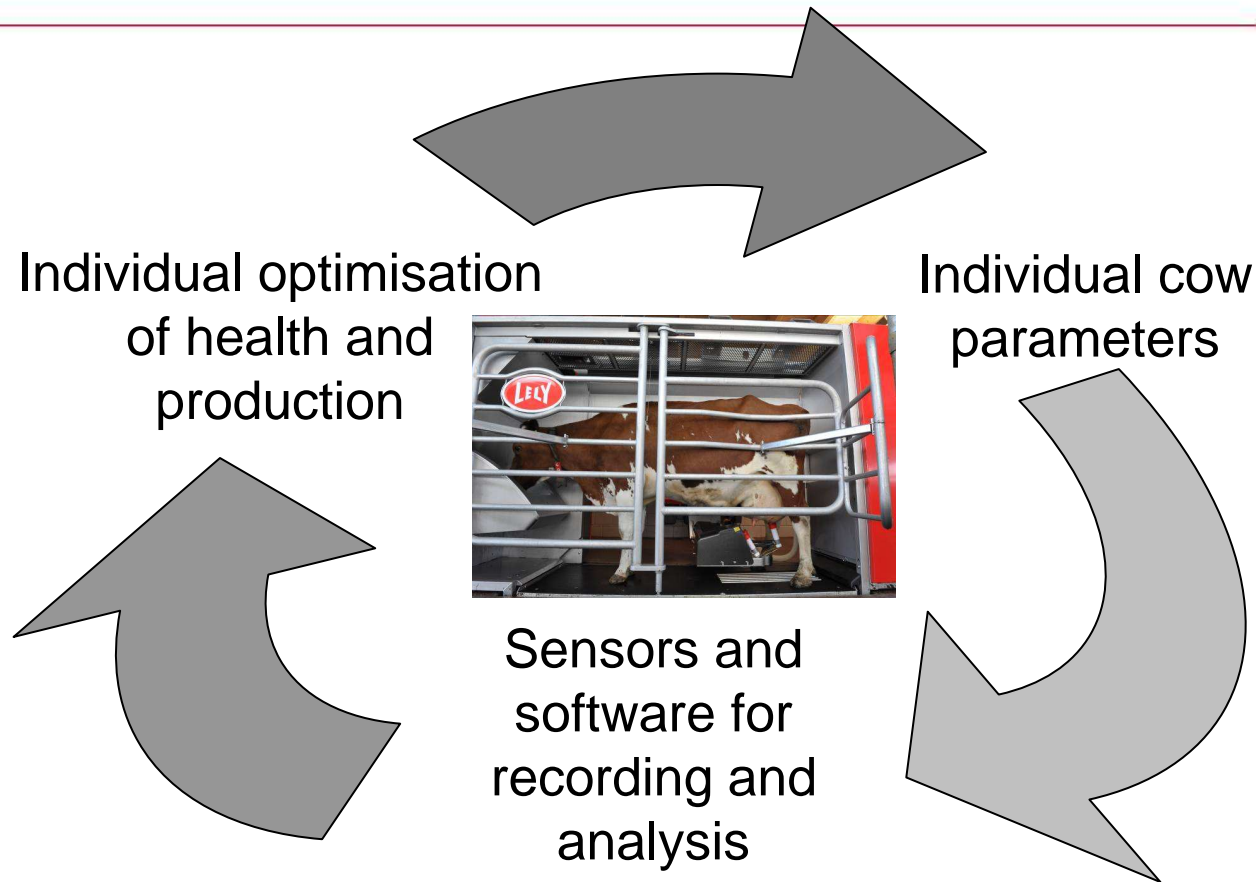
**Research &
Innovation**





Optimisation of performance

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Sensor development

- Cheap, reliable, non-invasive sensors
- Smart algorithms to improve accuracy
- Multi-use of one sensor
- Use of sensors from other industries
 - Automotive
 - Medical
 - Communication
- **Management by Exception**



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Exact or not?

- Is it relevant to know if you drive 120,462 km/hour or is it sufficient when you know that you drive 120 km/hour +/- 5 km?
- This means that as a user of the data you have to understand the meaning of the data.



Are the algorithms important....?

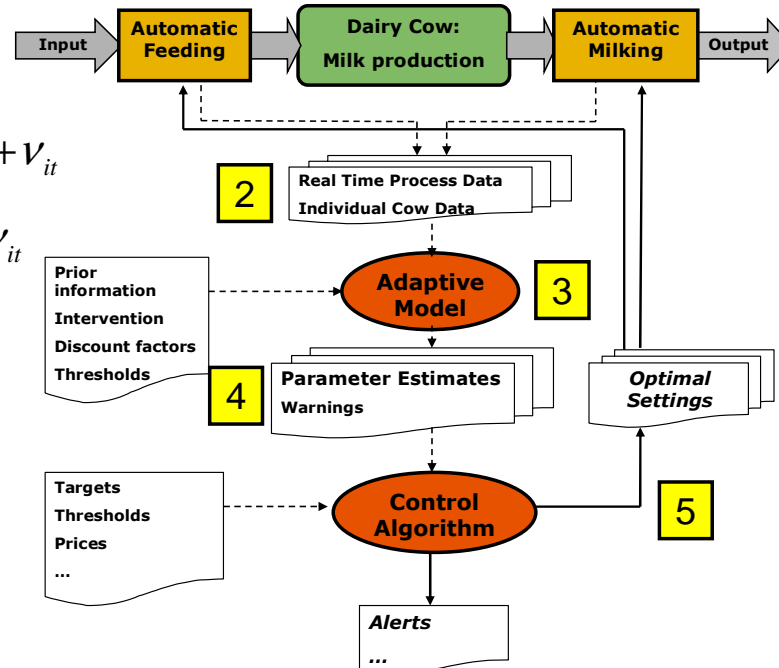
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$$\begin{aligned}
 Y_t &= \underline{M}_{it} = \left(\underline{c}_{0,it} + \underline{c}_{1,it} \underline{C}_{it} + \underline{c}_{2,it} \underline{C}_{it}^2 \right) \underline{I}_{it}^{(1)} + \underline{b}_{2,it} \underline{I}_{it}^{(2)} + v_{it} \\
 &= \underline{c}_{0,it} \underline{I}_{it}^{(1)} + \underline{c}_{1,it} \underline{C}_{it} \underline{I}_{it}^{(1)} + \underline{c}_{2,it} \underline{C}_{it}^2 \underline{I}_{it}^{(1)} + \underline{b}_{2,it} \underline{I}_{it}^{(2)} + v_{it} \\
 &= F_t' \theta_t + v_t
 \end{aligned}$$

$$\gamma_t \sim \text{Beta} \left[\delta_{v,t} n_{t-1} / 2, (1 - \delta_{v,t}) n_{t-1} / 2 \right]$$

$$R_t = GC_{t-1} G' / \delta_t = \begin{pmatrix} c_{11,t-1} / \delta_{t,1} & c_{12,t-1} \\ c_{21,t-1} & c_{22,t-1} / \delta_{t,2} \end{pmatrix}$$

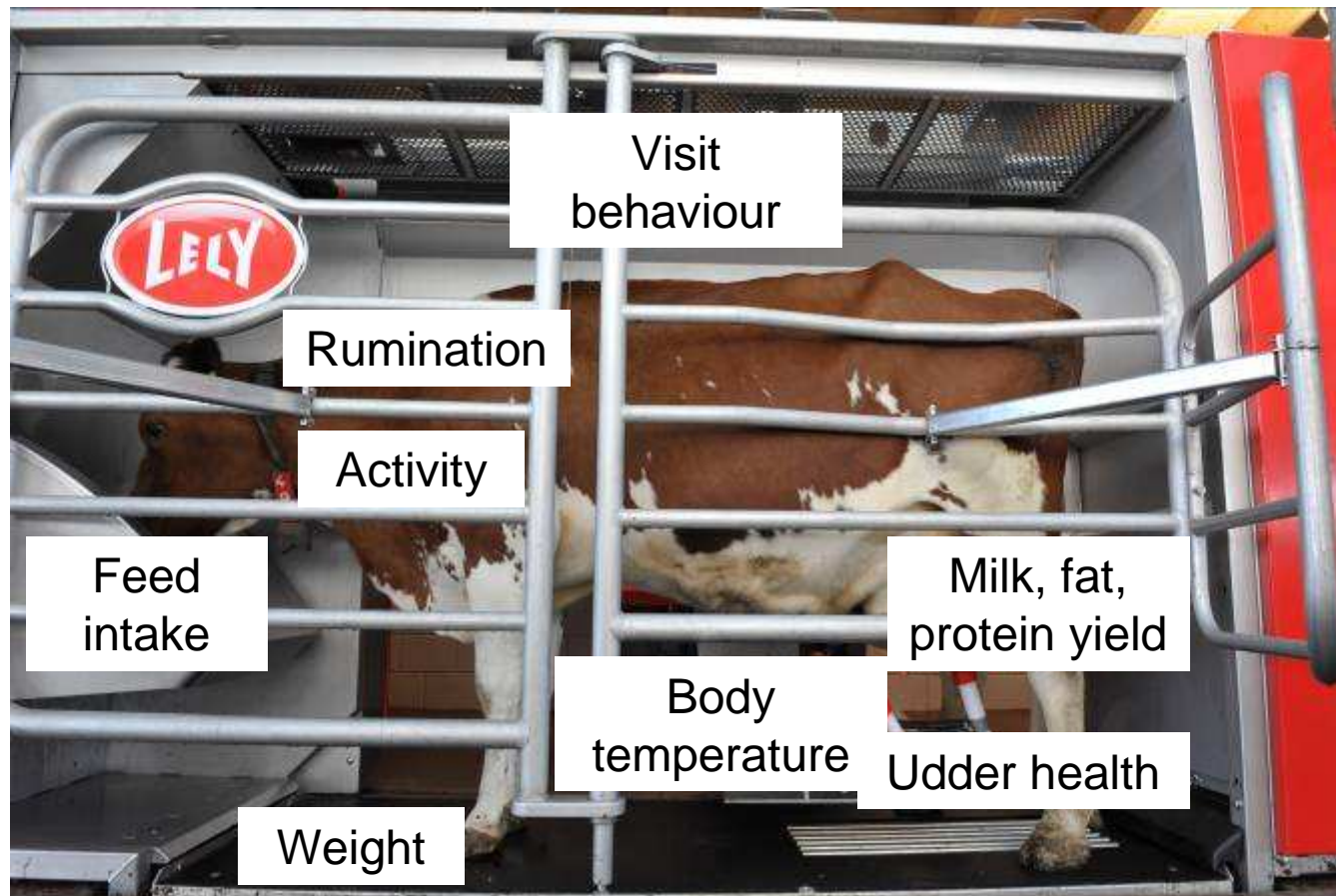
$$C_{Opt,it} = \frac{-\left(\pi_{M,it} \hat{c}_{1,it} - \pi_{C,it} - \pi_{R,it} \hat{d}_{1,it} \right)}{2\pi_{M,it} \hat{c}_{2,it}}$$





Sensors in practice

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Smart algorithms: mastitis detection

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	TP quarter	FN quarter	TN quarter	FP quarter	TP case	FN case	SE quarter	SP quarter	SE case
Farm 1	41	30	117949	693	12	2	57.75%	99.42%	85.71%
Farm 2	7	50	32237	161	4	0	12.28%	99.50%	100%
Farm 3	3	8	39292	399	2	0	27.27%	98.99%	100%
Average	51	88	189478	1253	18	2	36.69%	99.34%	90%

- ISO demand: 99+% SP, 70+% SE
- Practical results: 99+% SP, 90% SE
- 9 out of 10 mastitis cases detected
- 993 out of 1000 milkings correctly classified



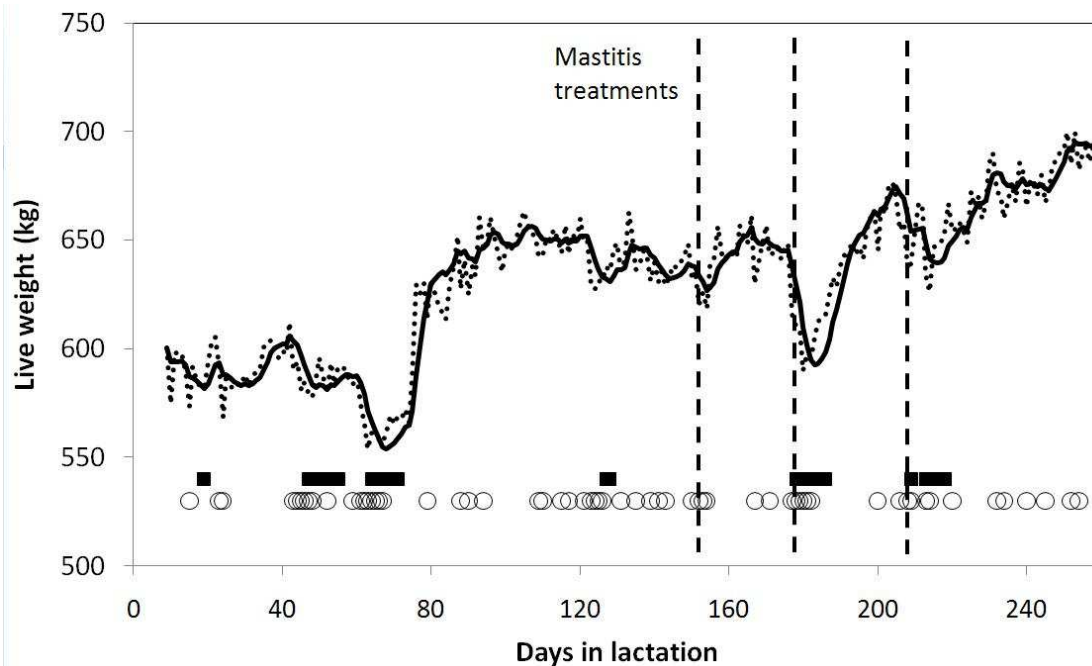
Smart algorithms: weight

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What is the weight of a cow??

Natural variation of +/-60kg in 24 hours.

By the use of a dynamic filter we are now accurate by 0,8% of the life weight (4-5 kg).





Home

Dashboard

Benchmark

Active Herds

Logout



Data Entry



Analysis/Reports



Configuration



Maintenance



E-Learning

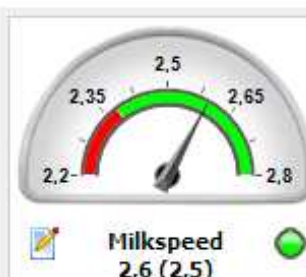
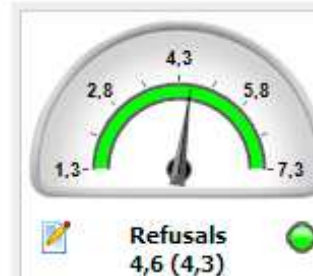
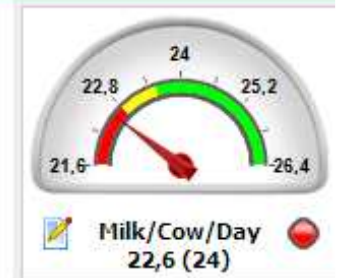
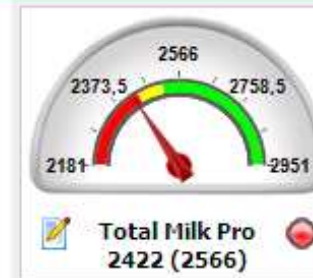
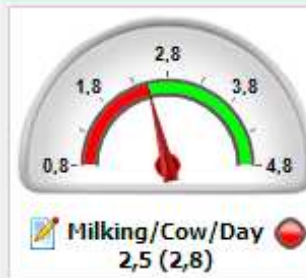
Attention List

Device	Type	Extra	Attention	Info
101	A3		Liner Attention	13193 Milkings

Favorite Reports

- Analyse - Concentrate/Kg Milk
- Analyse - Cow Lactations
- Calendar - Expected Calving
- Condition - Heat Probability
- Milking - Cows Too Late
- Milking - Day Production
- Milking - Failed Milkings
- Milking - Milkings/Hour
- Milking - Nr. Of Milkings/Cow/Day
- Milking - Udder Health
- Robot performance 10 days

User KPI's





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Where will we go?

Critical parameters for succes:

- General health
- Udder health
- Fertility
- **everything else is a consequence.....**





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Future developments

- Health – Cow “events”
- Behaviour and well-being
- Milk components
- Environment: carbon footprint





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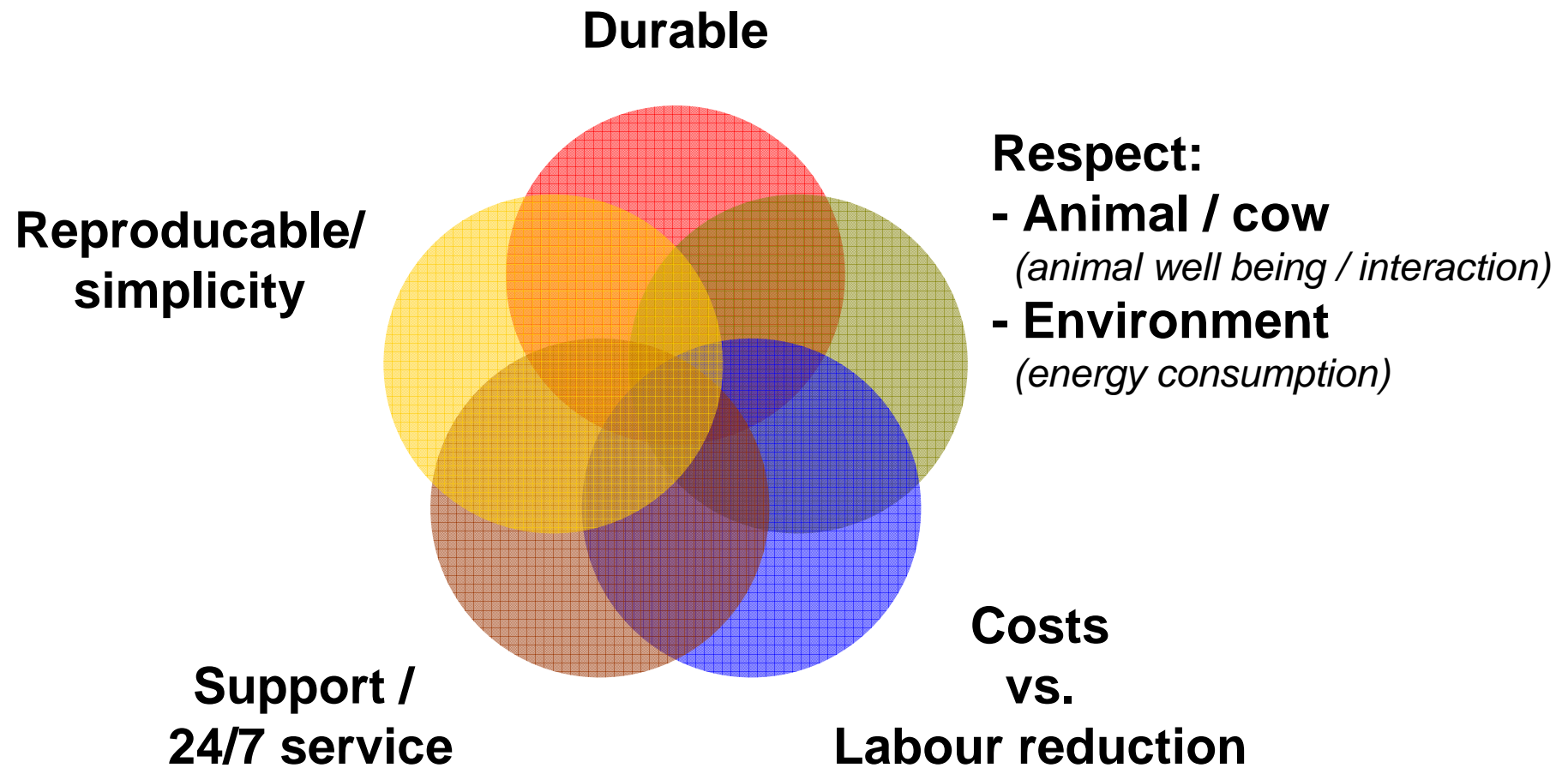
Future developments

- Further improvement of reliability
- Reduction of down time (lower service cost)
- Reduction of maintenance
- Offer “more for the same €”
- And obviously “ smart algorithms” to get the maximum information out of the available data.



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Balance





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