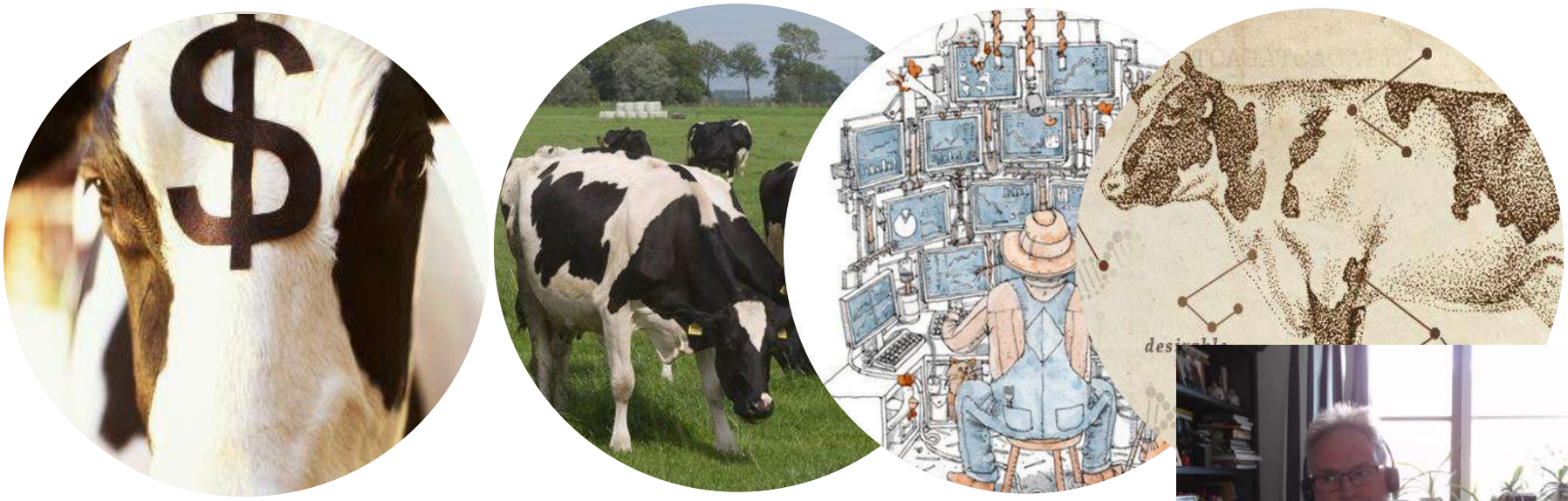
Economics of early detection of diseases by using BCS

Henk Hogeveen



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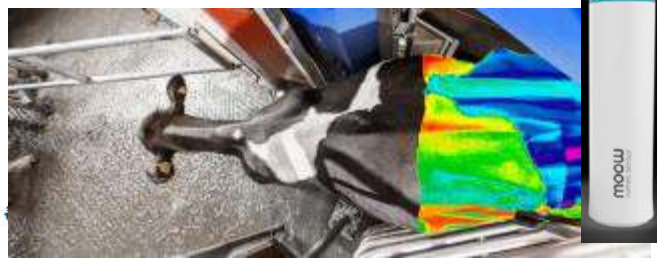
Precision dairy farming (PDF)

- Monitor physiological parameters related to production, health or fertility of individual cows
- Automatic detection of events (e.g. estrus and mastitis detection)

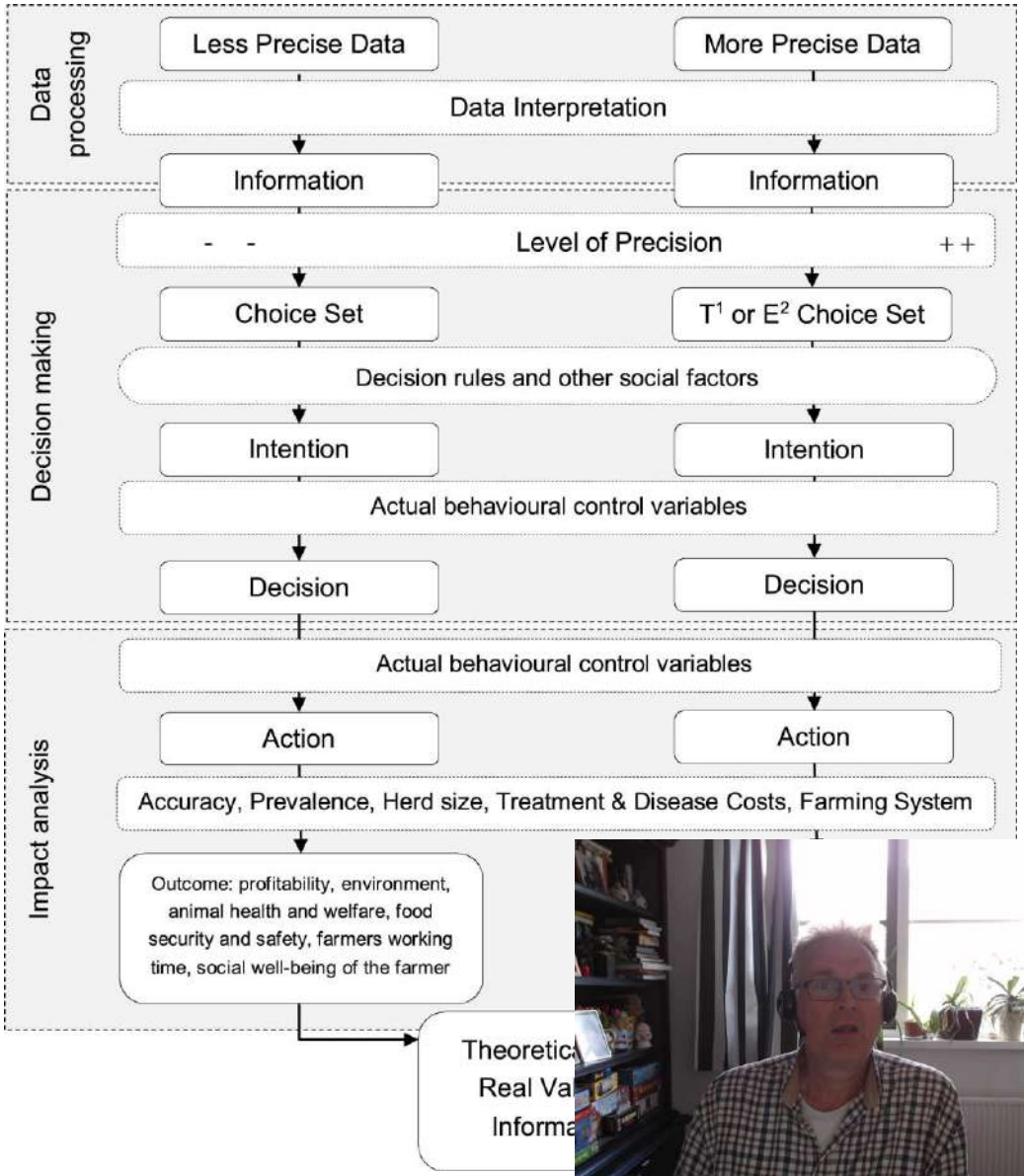


Economics of precision farming

- Same information for lower costs
  - Labour savings
  - Laboratory savings
- Better information
  - Precision
  - Number of measurements

Value of information

- Framework from an international group of researchers



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Assessment of the value of information of precision livestock farming: A conceptual framework

Cristina Rojo-Gimeno[a,b], Mariska van der Voort[c], Jarkko K. Niemi[d], Ludwig Lauwers[a,e], Anders Ringgaard Kristensen[f], Erwin Wauters[a,*]

So needed knowledge to evaluate economics of BCS sensors

- Comparison of information with and without BCS measurement
- What to do with information – management – choice sets
    - More choices
    - Better targeted choices
- Effect of choices
    - Diseases
    - Production, culling, expenditures
- Intention of farmers in using the choice set

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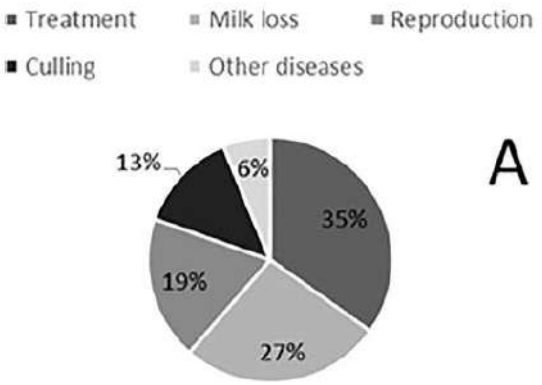
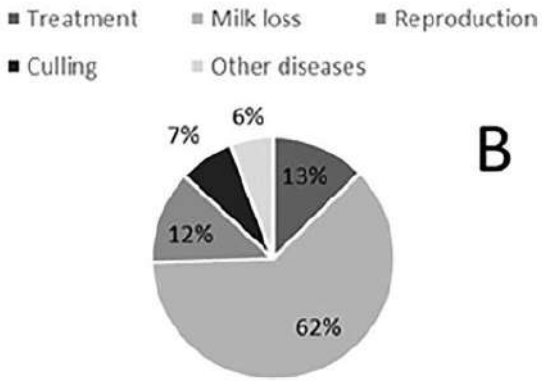
We know about costs of ketosis

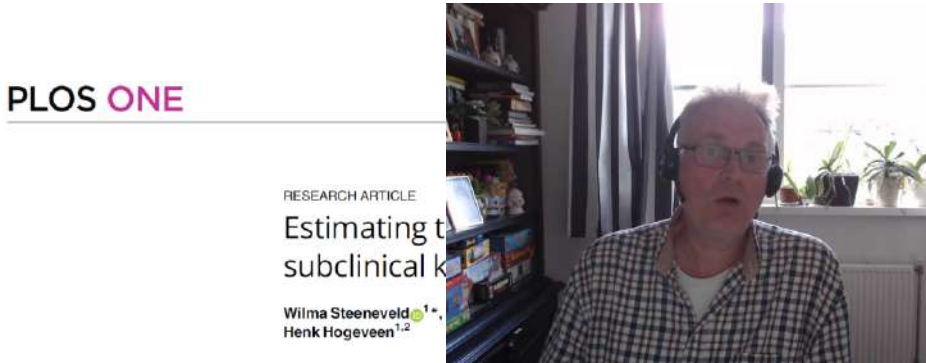


Clinical ketosis case: € 709 (64-1196)

Subclinical case: € 150 (18-422)



Overall: € 3,613 per farm (130 cows)



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How much ketosis can be reduced

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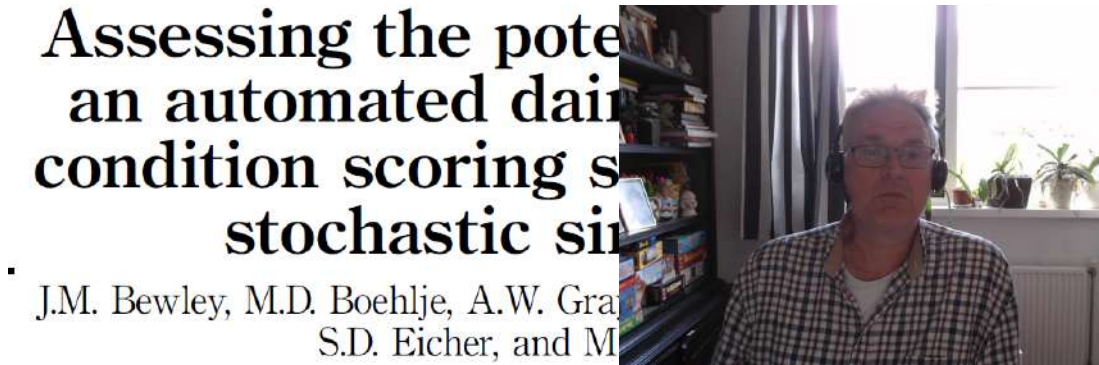
Literature highly theoretical

- Stochastic simulation model, with biological relationships
- BCS was modelled as well as odds of BCS with disease
- Potential benefit of automated BCS based on expert survey -> disease reduction



Potential benefits (1-6) - 45 US experts

Benefit	Rating
Disease reduction	1,86
Cohort management	2,95
Reproduction	3,09
Animal well-being	3,68
Energy efficiency	4,09
Genetics	5,32

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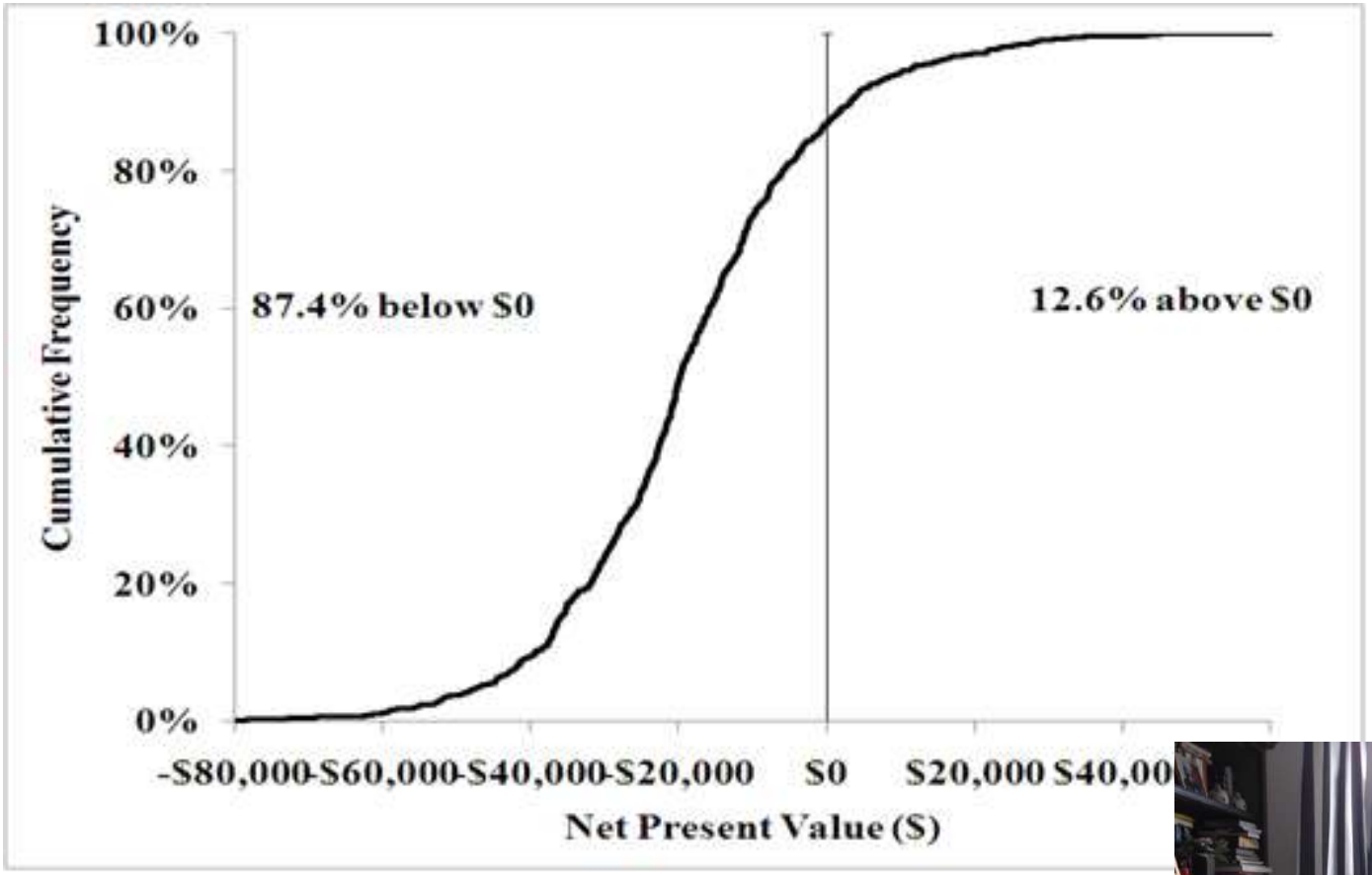
Results of modelling – based on all experts



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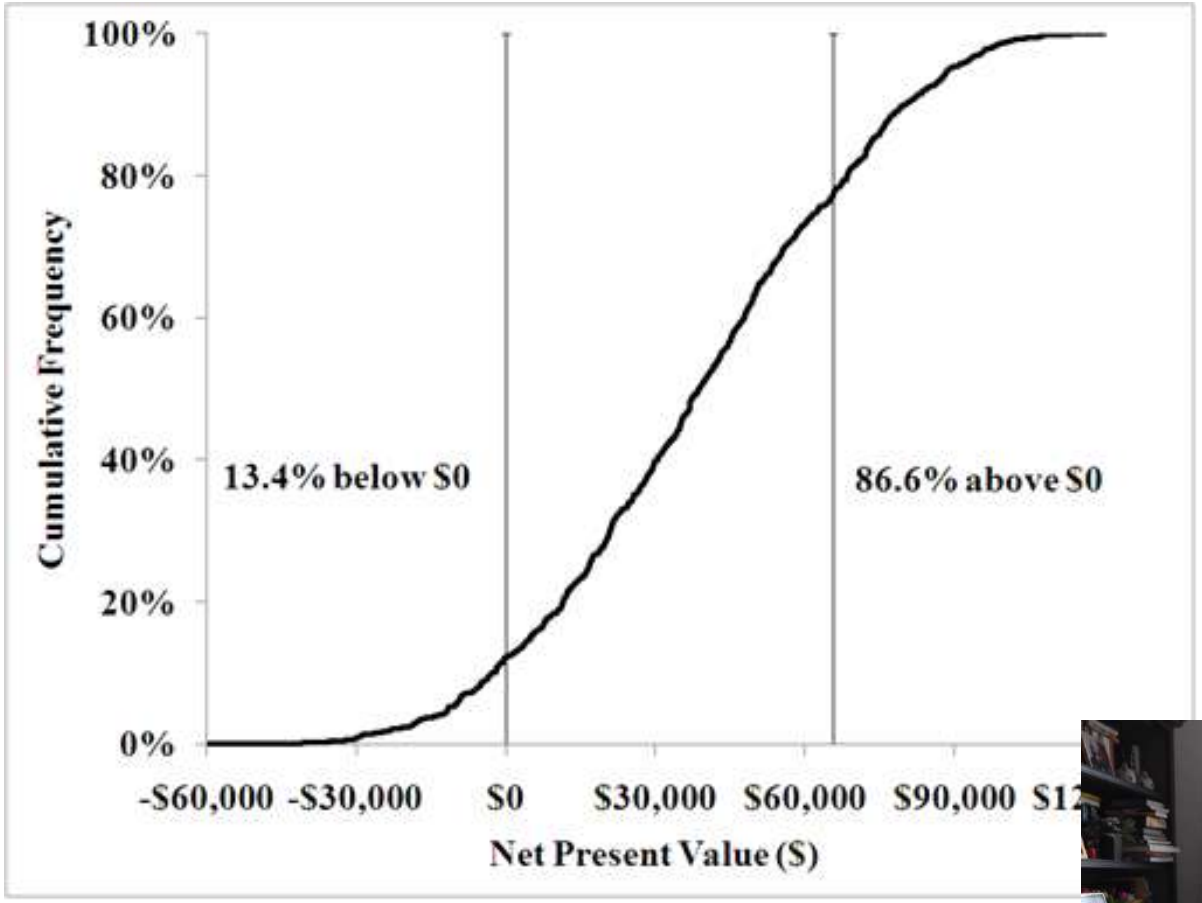
Results – 25% decrease cows score 3.25 at calving



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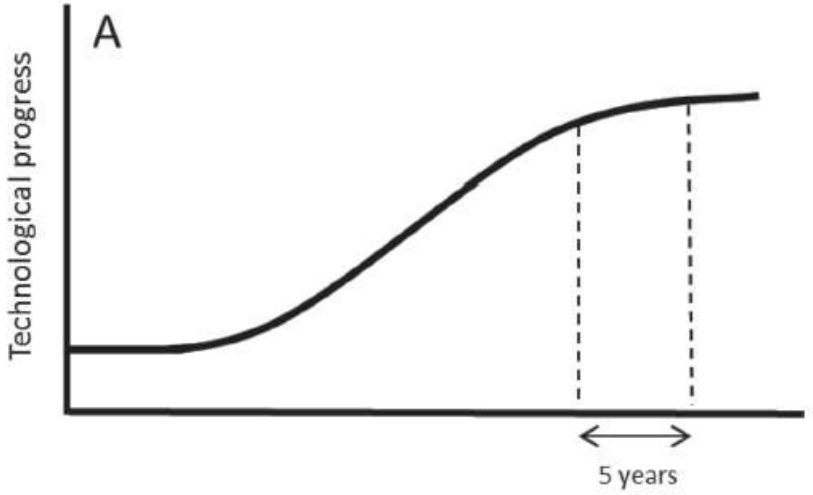
A second study – aimed at value of waiting to invest

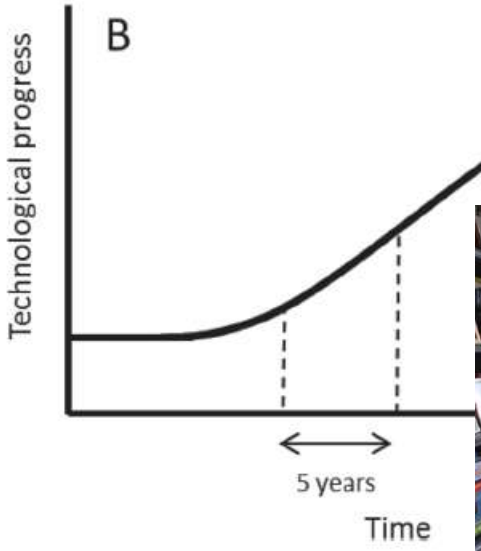
Explore the role of uncertainty about

future technological progress

in sensor technology

on the adoption of sensors by dairy farmers





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Delaying investments in sensor technology: The rationality of dairy farmers' investment decisions illustrated within the framework of real options theory

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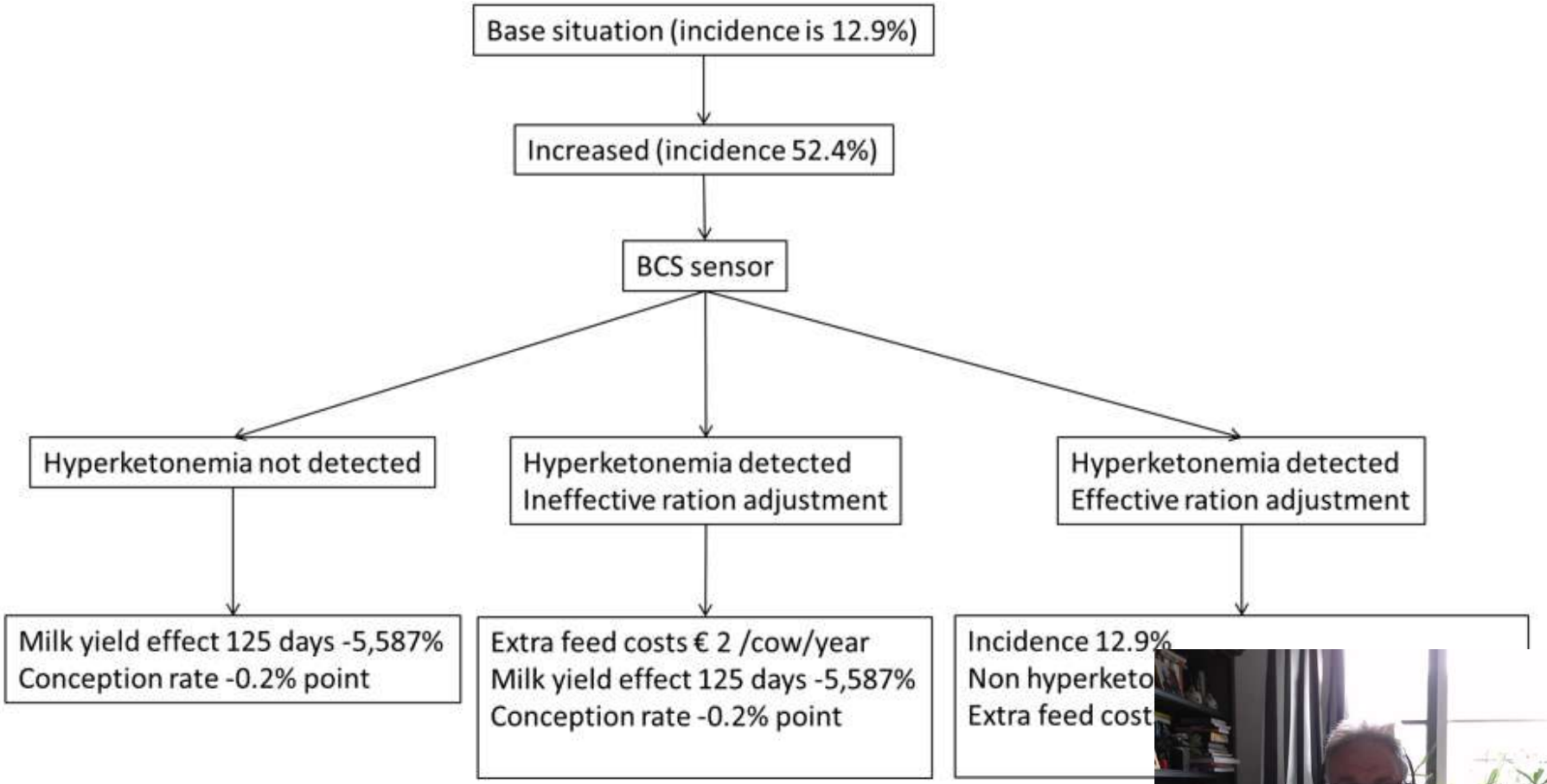
Real option theory

- Origin: option pricing in financial theory
- Early applications: investing in IT systems
- Calculate Net Present Value of investing now vs Net Present Value of investing over 5 years

Effects of detection of hyperketonemia



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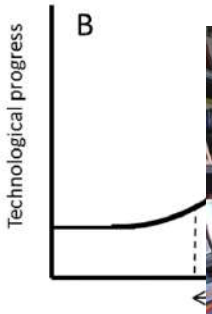
Input – Dutch circumstances

Variable	Value	Unit	Source
Herd size	100	Number	
Voluntary waiting period	84	Days	Inchaisri et al., 2010
Conception rate	50	%	Inchaisri et al., 2010
Milk production	8572	Kg/305 days	CRV, 2016
Ketosis			
Duration	125	Days	
Incidence	12.9	%	Adapted from Van der Drift et al., 2012
Elevated incidence	52.4	%	Adapted from Van der Drift et al., 2012
Effect on milk yield	-5.587	%	Adapted from Van der Drift et al., 2012
Milk yield effect non-ketotic cows after ration adjustment	0.5	%	Authors' expertise
Diseases			
Mastitis incidence	27	%	Van Soest et al., 2016
Relative risk for mastitis because of ketosis	3.33	-	Raboissc
Displaced abomasum incidence	5.1	%	Le Blanc
Relative risk for displaced abomasum because of ketosis	1.61	-	Raboissc

Performance BCS sensor

	Now	Postponed
Probilities		
Hyperketonemia not detected, no changed ration	33%	30%
Hyperketonemia detected, no effective ration change	33%	20%
Hyperketonemia detected,and effective ration change	33%	50%



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Economic calculations

- Difference net cash flow with and without sensor
  - Milk, labour, reproduction, treatments, culling

$$CF_t = \left(MM_t + MR_t + LC_t + TC_t + MC_t\right)$$

- Net present values of investments

$$NPV = (-INV + \sum_{t=1}^{10} \frac{CF_t}{(1+r)^t}$$

$$NPV = (-INV_5 + \sum_{t=6}^{15} \frac{CF_t}{(1+r)^t}$$

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Resultats body condition scoring

	Investment now	Postpone investment	Δ
Automated estrus detection			
Investment	14,400	14,400	0
Additional cash flow (€/year)	3,946	4,039	93
NPV (€)	15,043	12,350	-2,693
Automated body condition scoring			
Investment	8,000	8,000	0
Additional cash flow (€/year)	1,404	2,054	650
NPV (€)	-1,015	3,139	4,154

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Concluding remarks

- Value information framework – choice sets and uptake
- We do not know performance of BCS sensors
- Research so-far quite theoretical
    - Expert based
    - Assumption based
- Depending on situation, BCS sensors may be cost-effective
- Don’t forget other benefits then economic
    - Welfare, environment, supply chain

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Thank you for your attention

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