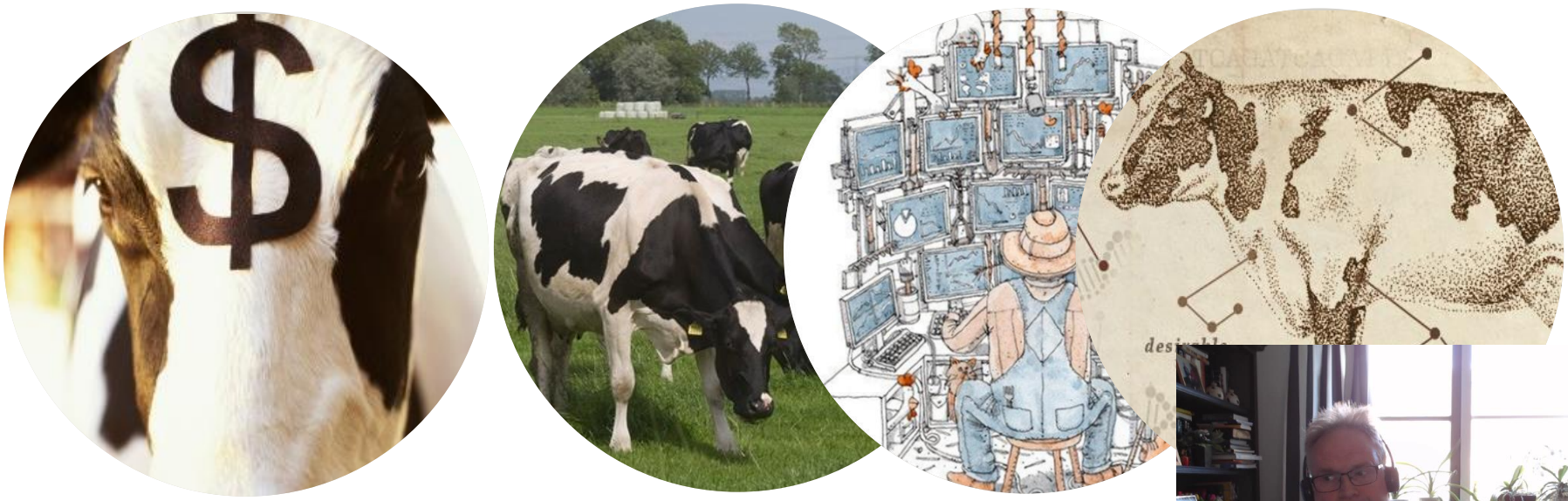
Economics of early detection of diseases by using BCS

Henk Hogeveen



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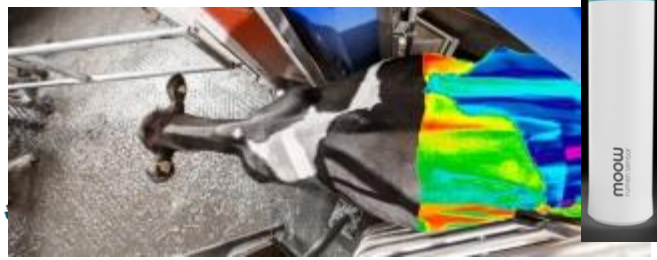
Precision dairy farming (PDF)

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

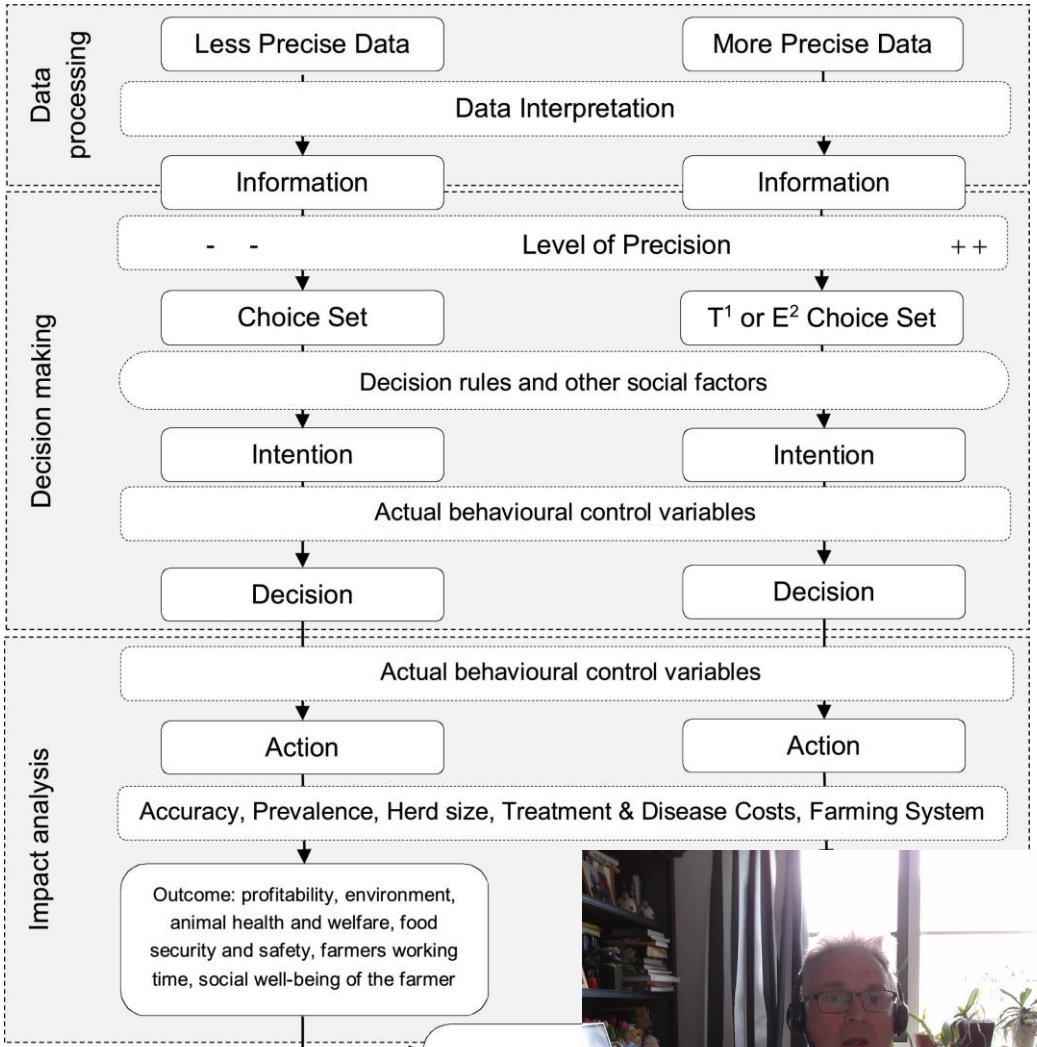


Economics of precision farming

- 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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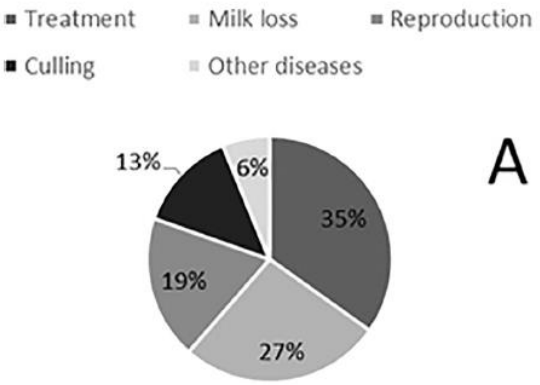
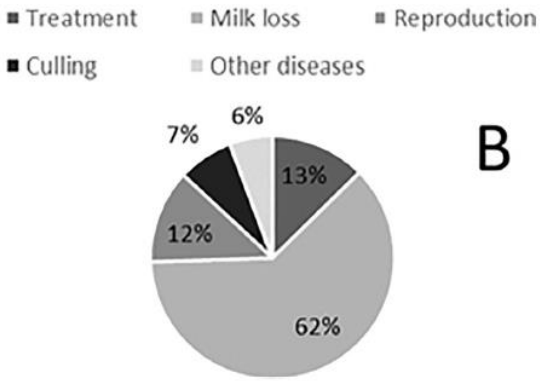
We know about costs of ketosis



Clinical ketosis case: € 709 (64-1196)

Subclinical case: € 150 (18-422)



Overall: € 3,613 per farm (130 cows)

PLOS ONE

RESEARCH ARTICLE

Estimating t
subclinical k

Wilma Steeneveld[1]*,
Henk Hogeveen[1,2]

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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

Assessing the pote
an automated dai
condition scoring s
stochastic si

J.M. Bewley, M.D. Boehlje, A.W. Gra
S.D. Eicher, and M

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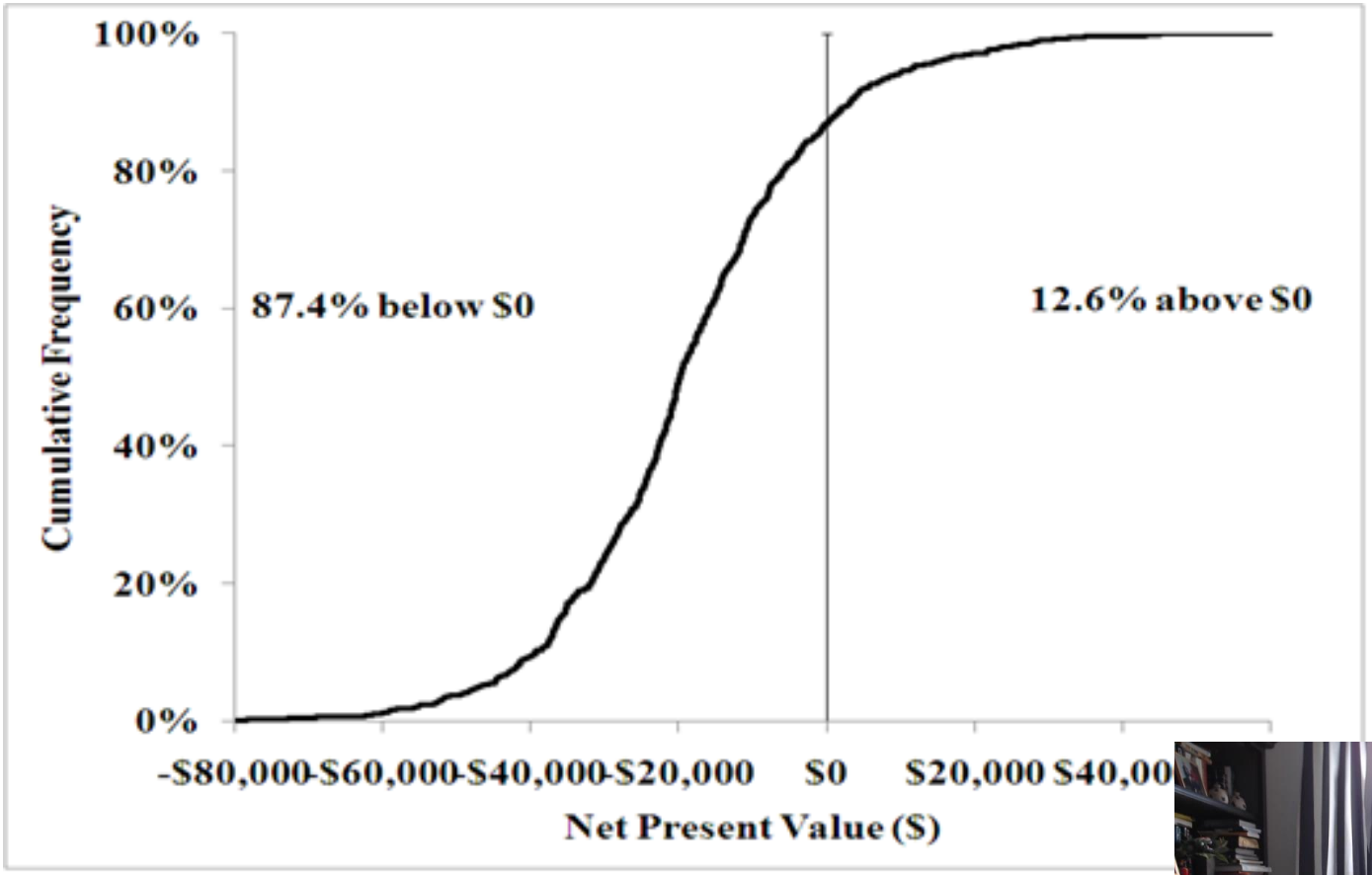
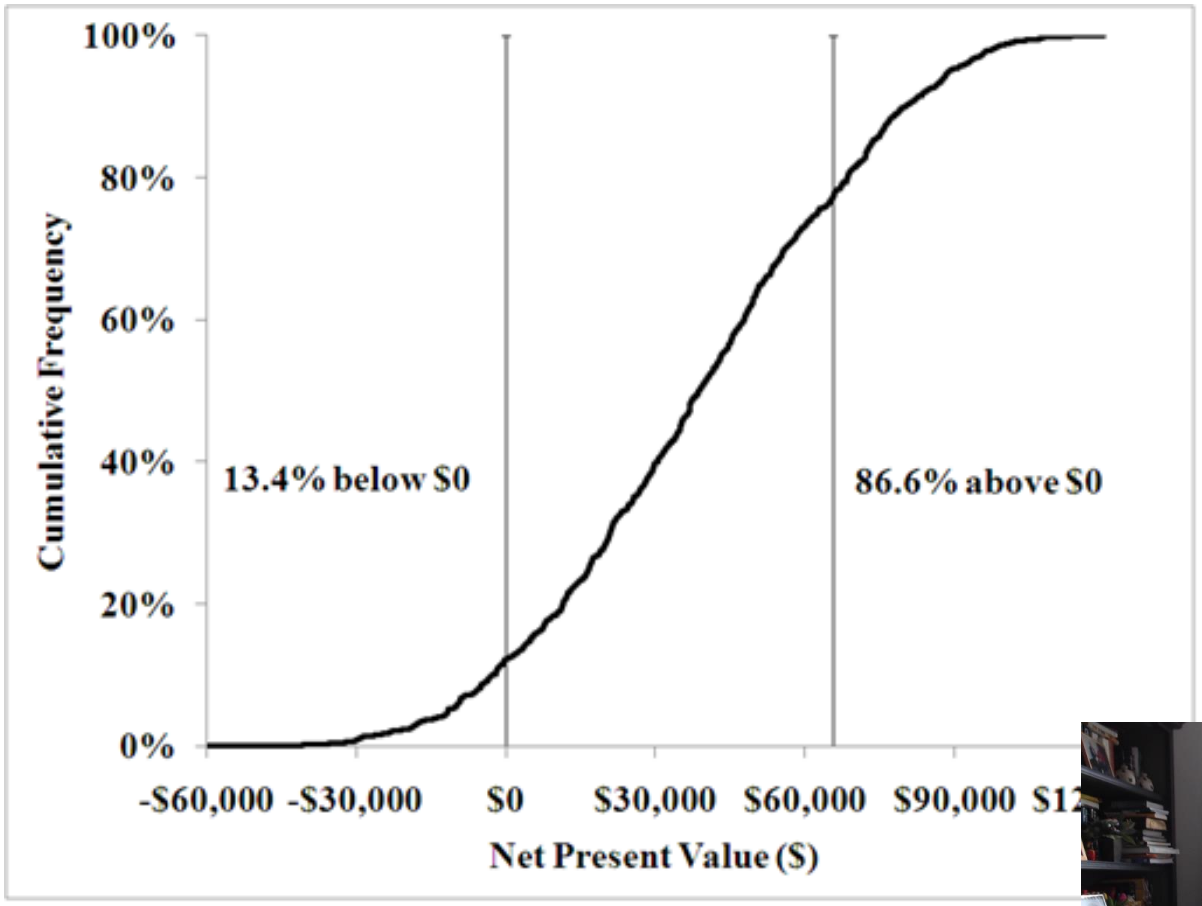
Potential benefits (1-6) - 45 US experts

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

Results of modelling – based on all experts



Results – 25% decrease cows score 3.25 at calving



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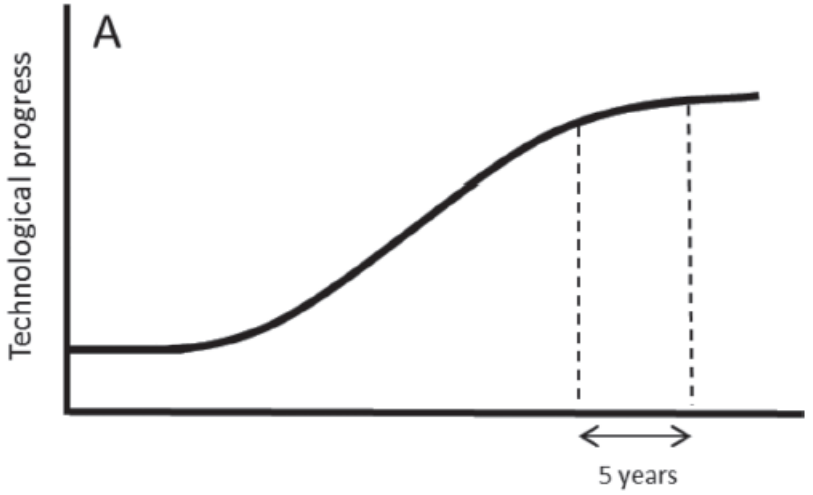
A second study – aimed at value of waiting to invest

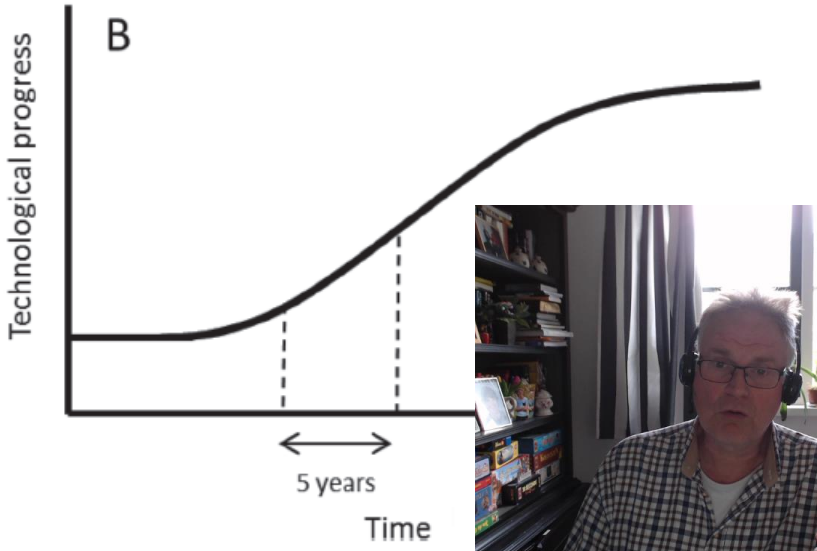
Explore the role of uncertainty about

future technological progress

in sensor technology

on the adoption of sensors by dairy farmers





J. Dairy Sci. 101:7650–7660
https://doi.org/10.3168/jds.2017-13358

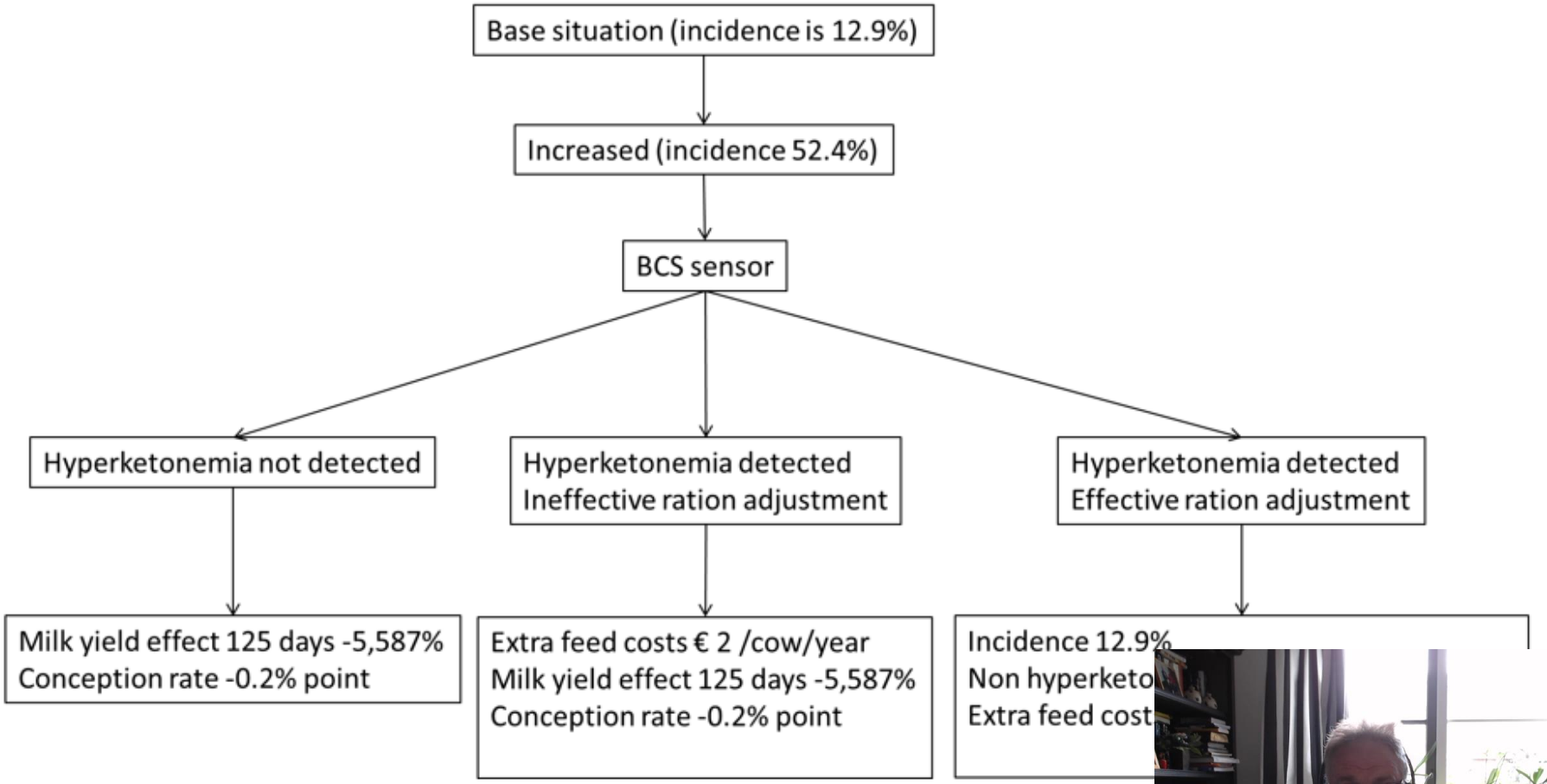
Delaying investments in sensor technology: The rationality of dairy farmers' investment decisions illustrated within the framework of real options theory

C. J. Rutten,* W. Steeneveld,*[1] A. G. J. M. Oude Lansink,† and H. Hogeveen*†

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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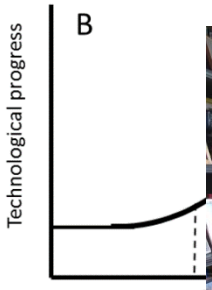
Input – Dutch circumstances

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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