Producentsammenslutningen Det Økologiske Akademi

Bæredygtig udvikling af landbrug

Det Økologiske Akademi, Niveau 2

Naturerhverv.dk
Ministeriet for Fødevarer, Landbrug og Fiskeri
Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne
Danmark og Europa investerer i landdistrikterne
Se 'European Agricultural Fund for Rural Development' (EAFRD)

BÆREDYGTIG UDVIKLING AF LANDBRUG

Med udgang i kvæg brug.

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MIN BAGGRUND, FORSKNINGSMÆSSIGT

DJF: Sensor networks (2006-2008)
DJF: PhD i bæredygtige teknologier til kvæg brug
AU: LCA (2009-
GUDP: Mobil mælkerobot (2006-2009)
MAF: Afgræsning også en del af fremtidens kvæg brug (2009-2012)
GUDP: Teknik til afgræsning (2011-2013)
EU: Autograssmilk (2013-2015)
FØL: Flerårige kløvergræsmarker til afgræsning (2013-2014).
ICTagri: Smart Integrated Livestock Farming

BÆREDYGTIGHED - DISPONERING

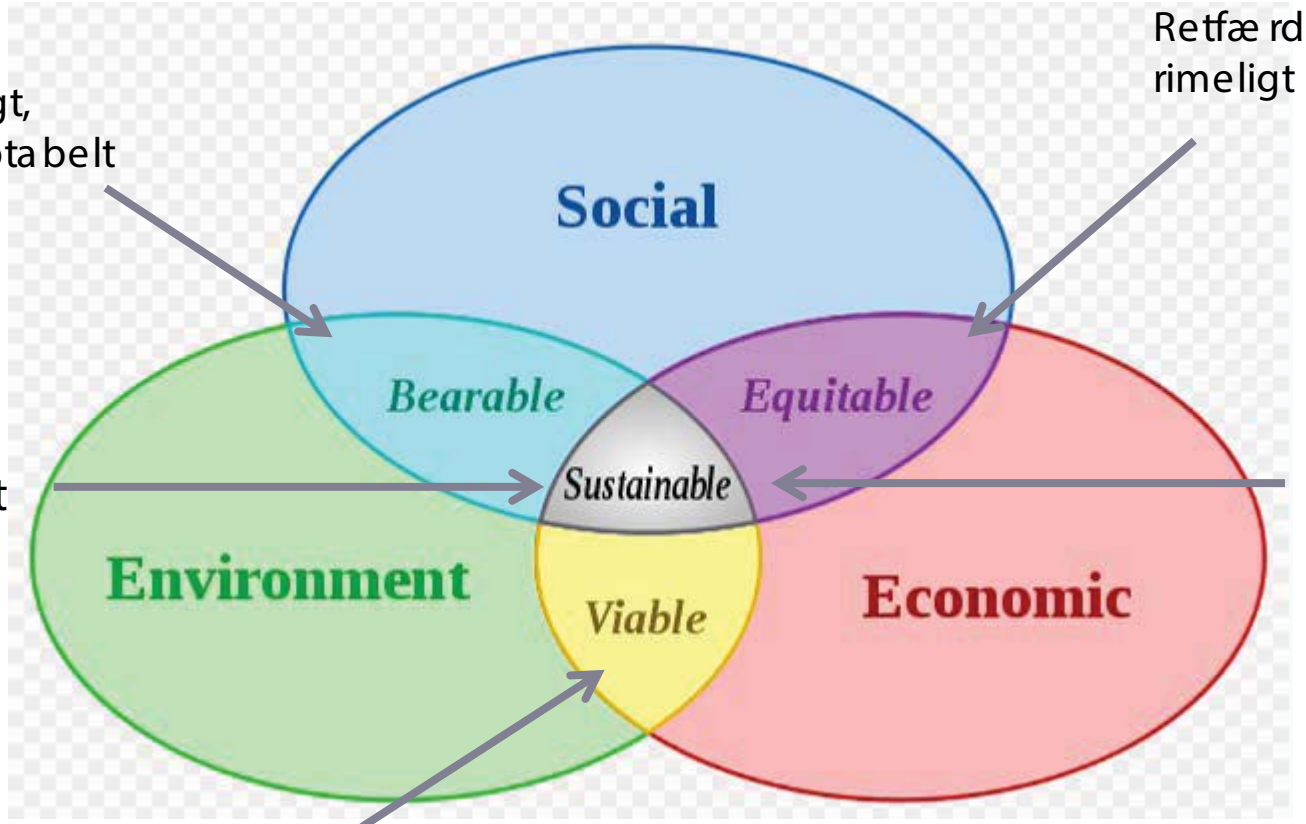
Kvantificering-hvorfor-teori-praksis
- lidt om dilemmaer i forskningen

Eksempler fra forskning
- AMS i Danmark
- Scenarier for økologisk kvæ gbrug
- Internationale dilemmaer

Vurdering, væ gtning, trade-off (bytte væ k)

Hvordan kunne det bruges i praksis

BÆREDYGTIG (UDVIKLING)



UDVIKLING KRÆVER KVANTIFICERING

Tema; social, miljø, økonomi, forvaltning (governance)

Subtema; Social, dyrevelfærd, arbejdsmiljø, trivsel, velvære

Miljø, atmosfære, jord, vand, landskab, natur

Økonomi, indkomst, gevinst, robusthed, gæld,

Forvaltning, demokratisk, fleksibel, overskueligt, …

FRA (SUB) TEMA TIL MÅLBAR ENHED

Indikatorer,
En parameter eller en værdi, der stammer fra parametre, som måler den aktuelle status for et (sub)tema.

F.eks. Dyrevelfærd. Antal behandlinger, slagteribemærkninger, plads per dyr indenfor, afgræsningsareal etc.

KRAV TIL INDIKATORER

Relevant	Behandlings indeks-dyrvelfærd
Simpel	Optælling af arter/sorter
Kvalitet	Seneste viden brugt
Mål, trend	
Tilgængelighed af data	Omkostninger, lukkethed etc.

EN INDIKATOR, FLERE PARAMETRE

Indikator: Klima påvirkning

Parametre: Metan
Lattergas
Kuldioxid
andre gasarter (CFC etc)

Karakterisering; standard måleenhed, kg CO_2-eq

REFERENCE, LOKAL, GLOBAL, MÅL RELATERET ?

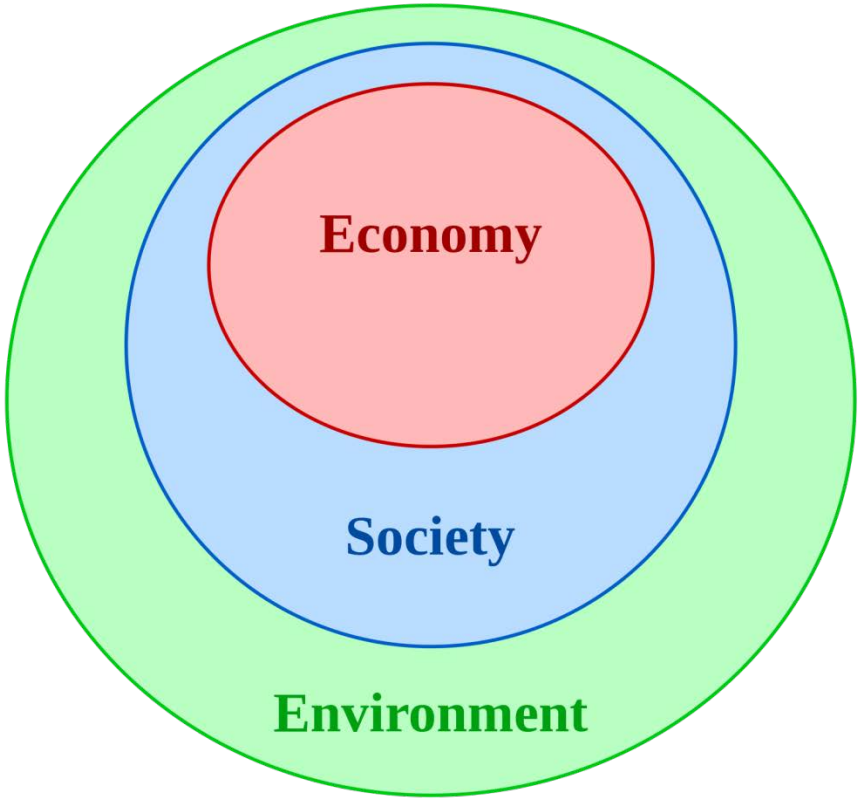
Holistisk / system orienteret

Afhængig af kontekst, lokal

Mekanistisk / disciplin orienteret

Beregner absolut værdier (IPCC, global), ofte hierarkisk (noget er vigtigere end andet)
(weak sustainability- natur først)

ECO (WEAK)-SUSTAINABILITY



SYSTEM BETRAGTNING / HOLISTISK

Involvering af interessenter (stakeholders).

Stakeholder analyse – valg af dem der skal bruges

Fokusgroup / SWOT / interview

Udvalgelse af tema, indikator, specificitet

Vurdering / vægtning

TRE EKSEMPLER AF IMPLEMENTERING

1. **Automatisk malkning i økologisk kvægbrug**
   Sustainability evaluation of automatic and conventional milking systems on organic dairy farms in Denmark. Wageningen Journal of Life Science
2. **Scenario analyse af økologisk kvægbrug**
   Economic and environmental evaluation of three goal-vision based scenarios for organic dairy farming in Denmark. Agricultural Systems.
3. **Autograssmilk** / dairyman index

AMS-CMS

Fokus gruppe interviews i DK og NL

Udvælgelse af tema og indikatorer

10 bedrifter AMS 10 bedrifter CMS

Indsamling af data

Vurdering

ØKONOMI

Table 2
Means and standard deviations (in parentheses) of economic indicators for organic dairy farms with an automatic milking system (AMS) and organic dairy farms with a conventional milking system (CMS) in 2005.

Indicator	Unit	AMS		CMS		*p*-value
Revenues milk sales	€ cow^{-1}	2910	(261)	2312	(325)	<0.001
Revenues rest	€ cow^{-1}	434	(142)	612	(411)	0.24
Variable costs	€ cow^{-1}	1253	(428)	1023	(428)	0.24
Fixed costs	€ cow^{-1}	1221	(367)	1275	(278)	0.73
Financing costs[a]	€ cow^{-1}	620	(259)	723	(329)	0.47
Debts	% of net worth	46	(18)	56	(13)	0.26
Net profit[b]	×€1000	161	(54)	123	(69)	0.21
Gross margin[c]	€ cow^{-1}	2719	(385)	2258	(532)	0.27

[a] Financing costs are interest costs on mortgage, loans, and investments together with rent paid for land use.
[b] Net profit is the gross income (from milk, animals, meat, and other products) minus fixed costs (maintenance, wages, energy, contract work), variable costs (feed, fertilizer) and financing costs (interest, rent).
[c] Gross margin is total income per cow minus the variable costs per cow and variable costs for the young stock necessary to maintain the herd.

MÆLK KVALITET

Table 5. Mean milk quality indicators for dairy farms with an automatic milking system (AMS) and with a conventional milking system (CMS) in 2005 (SD in parentheses)

Indicator	Dimension	AMS		CMS		*P* value
SCC[1)] dairy delivery	10^3/ml	219	(67)	226	(65)	0.83
SCC milk recording	10^3/ml	300	(104)	257	(61)	0.33
Clostridium spores winter	10^3/l	297	(246)	313	(342)	0.91
Clostridium spores summer	10^3/l	411	(661)	244	(108)	0.49
Acid degree value (ADV)	meq/l	0.78	(0.16)	0.49	(0.11)	<0.001
Fat	%	3.94	(0.20)	4.05	(0.16)	0.23
Protein	%	3.41	(0.10)	3.32	(0.12)	0.11
Urea summer	mmol/l	3.64	(0.50)	3.43	(0.58)	0.42
Urea winter	mmol/l	3.69	(0.48)	3.47	(0.46)	0.37
Milking frequency summer	milkings/day	2.4	(0.11)	2	(0)	0.002
Milking frequency winter	milkings/day	2.7	(0.31)	2	(0)	<0.001
Flow per milking winter	kg/milking	10.3	(0.82)	12	(1.44)	0.008

[1)] SCC: Somatic cell count.

MILJØ

Table 3
Means and standard deviations (in parentheses) of results of environmental indicators for organic dairy farms with an automatic milking system (AMS) and organic dairy farms with a conventional milking system (CMS) in 2005.

Indicator	Unit	AMS		CMS		*p*-value
N surplus at farm level	kg N per ha	110	(29)	66	(40)	0.02
P surplus at farm level	kg P per ha	8.8	(6.6)	3.4	(8.7)	0.16
N surplus on grazing pasture	kg N per ha	92	(82)	166	(60)	0.05
N surplus on mowing pasture	kg N per ha	148	(79)	53	(80)	0.03
Average field size	ha	5.0	(1.1)	5.3	(3.8)	0.84
Plant species grazing fields	#ha^{-1}	5.4	(1.3)	5.6	(2.1)	0.83
Plant species mowing fields	# ha^{-1}	3.4	(2)	2.4	(1.1)	0.20

DYREVELFÆRD OG SUNDHED

Table 6
Means and standard deviation (in parentheses) of health indicators for nine organic dairy farms with an automatic milking system (AMS) and for nine organic dairy farms with a conventional milking system (CMS). Treatment indicators are computed as the number of treatments per cow (i.e., 0.04 means 4 out of 100 cows were treated).

Indicator	AMS		CMS		*p*-value
Claw treatments (summer)[a]	0.04	(0.03)	0.02	(0.02)	0.30
Claw treatments (winter)	0.03	(0.01)	0.02	(0.02)	0.34
Mastitis treatments (summer)	0.25	(0.20)	0.18	(0.15)	0.44
Mastitis treatments (winter)	0.19	(0.09)	0.20	(0.14)	0.82
Reproduction treatments (summer)	0.10	(0.05)	0.09	(0.06)	0.89
Reproduction treatments (winter)	0.09	(0.08)	0.09	(0.06)	0.89
Sum[b] all treatments (summer)	0.48	(0.24)	0.33	(0.23)	0.20
Sum all treatments (winter)	0.40	(0.09)	0.32	(0.21)	0.31
Sum all treatments	0.88	(0.29)	0.65	(0.43)	0.21
Dead cows per year (%)	3.9	(1.7)	2.7	(1.6)	0.17
Dead calves after 180 days (%)	3.4	(2.6)	6.0	(5.6)	0.23
Born dead calves per year (%)	7.5	(3.3)	5.7	(2.5)	0.22
Culling rate (%)	38	(6)	32	(5)	0.05
Vet costs (€ per cow per year)	86	(43)	60	(31)	0.17

[a] Summer: May–October; winter: January–April.
[b] Sum comprises more than the 3 treatment groups mentioned in this table.

AFGRÆSNING OG ARBEJDE

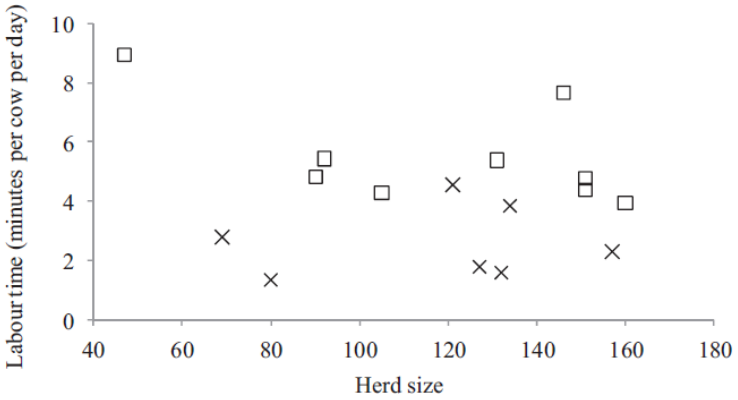


Table 4
Means and standard deviations (in parentheses) of grazing indicators for organic dairy farms with an automatic milking system (AMS) and organic dairy farms with a conventional milking system (CMS) in 2005.

Parameter	Unit	AMS		CMS		*p*-value
Grazing time[a]	h year^{-1}	968	(198)	2083	(788)	<0.001
Grass intake from pasture	kg DM[b] per day	5.4	(1.6)	6.9	2.2)	0.09
Grass intake from pasture	% of total diet	40	(14)	29	(8)	0.05

[a] Grazing time is computed from registered number of hours grazing per day (24 h) specified for spring, summer and autumn, and which months.
[b] DM: dry matter.

1.KONKLUSIONER

Målt på de parametre som stakeholders prioriterede.

Økonomi -
Miljø -
Social produktkvalitet
arbejde
afgræsning / dyrvelfærd

Svært at konkludere noget, skulle have haft feedback

2. SCENARIO ANALYSE

Forberedelse af rapport om muligheder og barrierer i den økologiske produktion (2008).

Fokus på:
Dyrevelfærd, miljø.
Tre scenarier defineret; BAU, dyrevenligt, miljøvenligt

Brug af videnskabelige rapporter til at definere konsekvenserne af disse scenarier.

RESULTATER

Kun økonomiske og miljømæssige parametre blev kvantificeret og vurderet.

Table 2
Schematic overview of issues and parameters used for evaluation.

	Issues	Parameters	Method	Unit
Economic	Profitability	Net profit	Empiric	€/Farm
Environmental	Eutrophication	Nitrogen balance	Model	kg N ha^{-1}
	Climate change	GHG-emissions	Model	Eq CO_2 kg ECM^{-1} MPU^{-1}
	Energy	Fuel	Model/empiric	MJ kg ECM^{-1}
		Electricity	Model/empiric	MJ kg ECM^{-1}

ØKONOMI

Table 5
Cost-benefit analysis of three scenarios for organic dairy production in Denmark, i.e. business as usual (BAU), animal welfare (ANW) and environmental scenario (ENV), including a sensitivity analysis for milk and meat prices, and fixed costs.

	BAU	ANW	ENV
Revenues, € year^{-1}			
Milk	853,217	647,996	465,901
Product quality regulation	−30,614	38,686	11,126
Meat	64,772	93,569	65,831
Sum	887,375	780,252	542,859
Costs, € year^{-1}			
Contract work	106,253	76,117	90,782
Handling of manure	10,261	11,310	8532
Concentrates	181,166	115,266	0
Labor, livestock	101,933	162,847	139,281
Straw	3377	45,222	6427
Veterinary	43,619	34,718	25,771
Energy	8713	6448	4792
Fixed costs	309,015	246,716	166,153
Financing costs	139,410	136,394	88,807
Sum	903,747	835,038	530,544
Net profit per farm, € year^{-1}	−16,371	−54,786	12,315
Milk price reduction 10% kg^{-1}	−101,693	−119,586	−34,275
Fixed costs decrease 10% cow^{-1}	7757	−31,227	28,233
Meat price increase 10% kg^{-1}	−9894	−45,429	18,898

Table 6
Nitrogen (N) surplus, greenhouse gas emission, and fossil energy use per year for three scenarios for organic dairy production in Denmark, i.e., business as usual (BAU), animal welfare (ANW) and environmental scenario (ENV).

	BAU	ANW	ENV
Farm N-balance			
N-surplus (kg ha^{-1})	117	116	80
N input[a] (kg ha^{-1})	169	160	109
N output[b] (kg ha^{-1})	51	44	30
N-surplus (g kg ECM^{-1})	12	16	15
Greenhouse gas emissions			
Total (kg CO_2-eq)	2506,866	2138,567	1294,910
Proportional (%)	100	85	52
Kg CO_2-eq per kg ECM[c]	1.32	1.48	1.25
Proportional per kg ECM (%)	100	112	95
kg CO_2-eq per cow	12,534	11,560	10,791
Proportional per cow (%)	100	92	79
Caused by enteric fermentation [EF] (%)	23	28	36
Proportional EF per cow (%)	100	92	106
Caused by energy consumption (%)	26	24	25
Fossil energy consumption			
Total (MJ)	6112,492	4801,745	2955,180
Proportional (%)	100	79	48
Per kg ECM	3.22	3.33	2.85
Proportional per kg ECM (%)	100	104	89

[a] N input comprises N in seed, N-fixation, concentrates and precipitation.
[b] N output comprises N in milk and meat.
[c] ECM is energy-corrected milk.

2. KONKLUSION

BAU fører til høje lokale miljø belastninger, uden at det forbedrer økonomien

Dyrevelfærd koster både indtægt og belastning per kg mælk og per ha.

Miljø scenario med selvforsyning scorer bedst

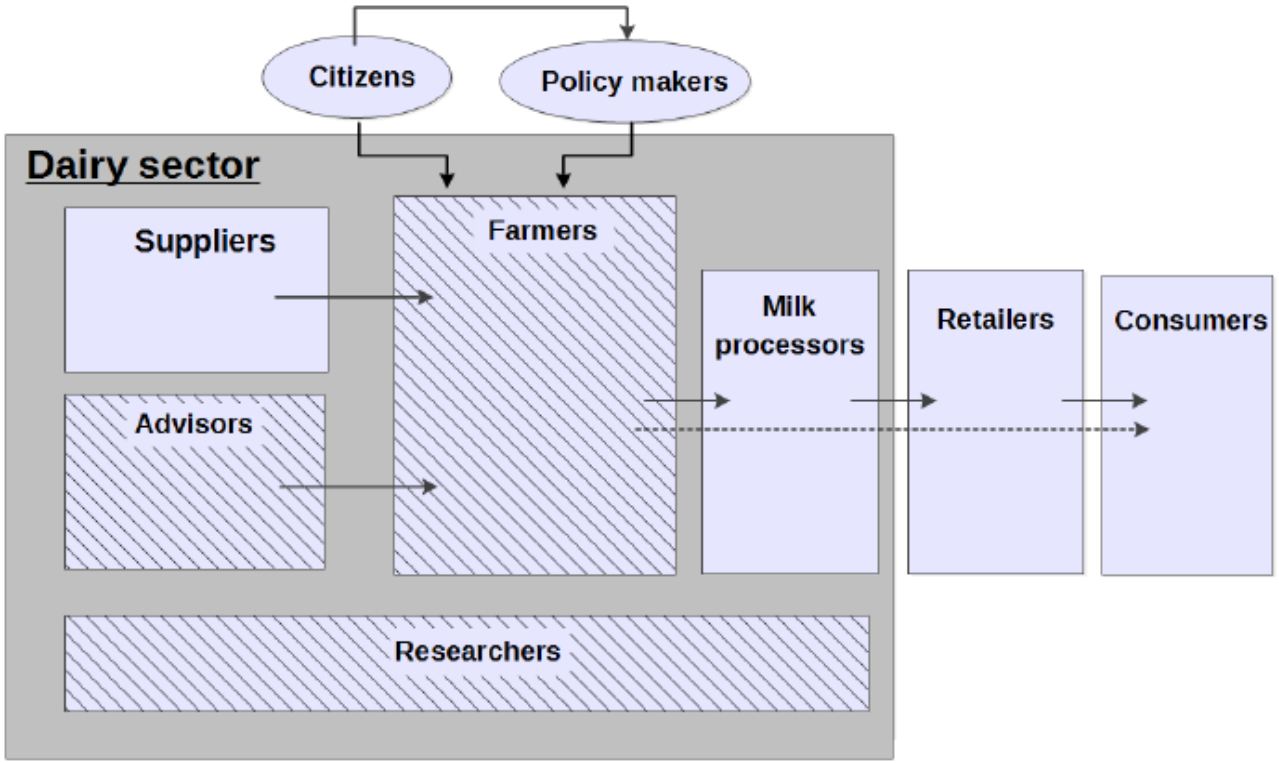
Det er op til den enkelte landmand at vælge

3. AUTOGRASSMILK (AGM)

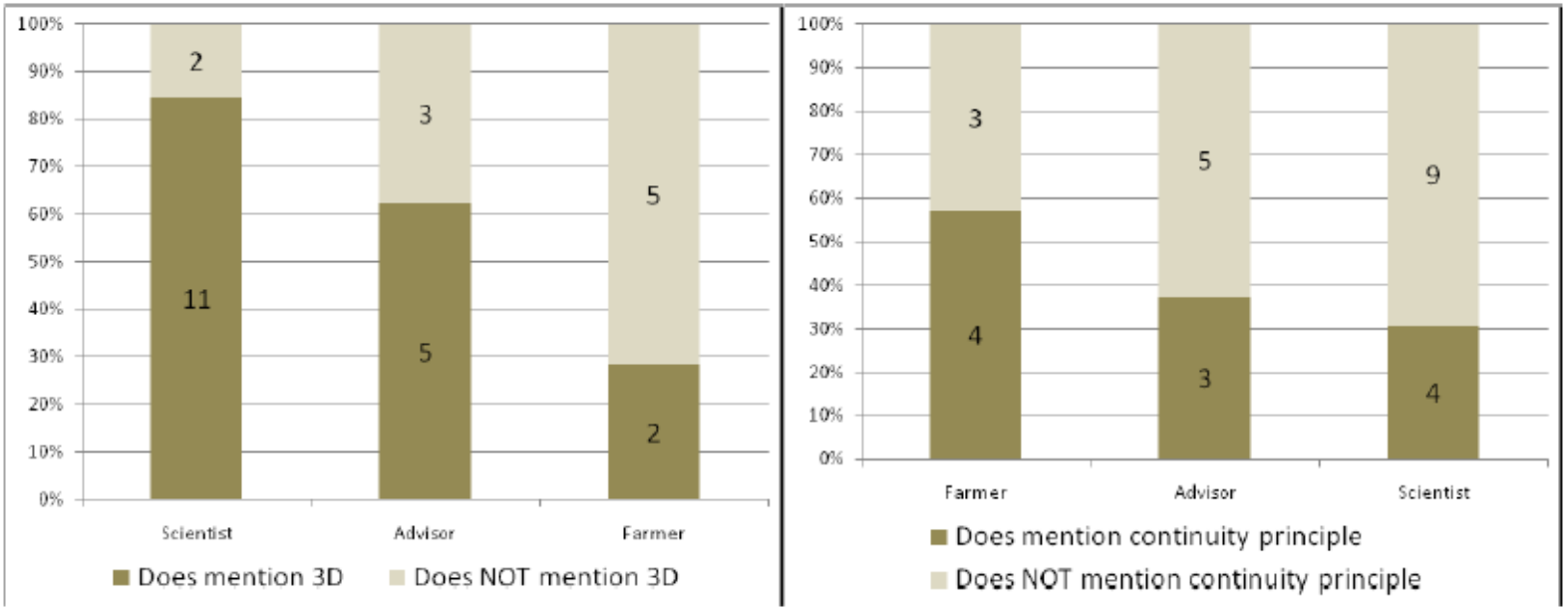
International projekt
Hvordan vurderer man parametre som er indsamlet ens ?

Stakeholder analyse for at evaluere hvilke interessenter der skal rådføres til at vurdere mål og "mission".

STAKEHOLDER ANALYSE AGM



FORSKEL I OPFATTELSE AF BÆREDYGTIGHED



(a) 3 dimensions principle

(b) continuity principle

Figure 3.6: Spontaneous evocation of the three sustainability dimensions (3D) and continuity principle per stakeholder type

Laurent Couty, 2013

ØKONOMI

Table 3.12: Economic sustainability themes cited by stakeholders (n=28)

		helped			
Theme	***spontaneously***	*++*	*+/-*	*–*	***SUM***
Production costs	18	1	0	0	19
Security / vulnerability	7	11	2	0	18
Remuneration	14	3	2	0	17
Durability	3	12	2	1	15
Efficiency	10	3	0	0	13

SOCIALE ASPEKTER

Table 3.13: Social sustainability themes cited by stakeholders

		helped			
Theme	***spontaneously***	*++*	*+/-*	*–*	***SUM***
Work quantity	19	2	0	0	21
Links outside people	11	5	3	0	16
Work quality	11	4	1	1	15
Animal welfare	7	8	6	1	15
Job creation	3	6	9	3	9
Farmer education	5	0	0	0	5
Links inside people	3	0	0	0	3
Image society	3	0	0	0	3
Landscape integration	0	2	2	3	2
Product quality	0	1	0	1	1

MILJØ ASPEKTER

Table 3.14: Environmental sustainability themes cited by stakeholders

		helped			
Theme	***spontaneously***	*++*	*+/-*	*–*	***SUM***
Water quality	16	3	1	0	19
Atmosphere quality	12	4	5	0	16
Water quantity	3	10	0	3	13
Biodiversity	8	4	8	0	12
Energy use	8	3	3	0	11
Land use	1	10	8	1	11
Soil quality	6	4	4	2	10
Landscape maintenance	3	0	1	0	3

SAMLET

Table 3.15: Sustainability themes and indicators seen as the most important for the combination AMS and grazing by interviewed stakeholders (n=28).

Economy	Social	Environment
Investment-related costs and debts (4)	Work quality (3)	Energy consumption (3)
Variable running costs due to AMS (5)	Work quantity (3)	Minerals emissions (3)
Feeding costs (4)	Opinion external people (1)	Biodiversity (3)

SPECIFICITET ELLER GENERALITET

Ud fra stakeholder opinion besluttes der hvilke indikatorer prioriteres og detaljeringsniveau (forskningsbaseret)

Biodiversitet, livscyklus eller on-farm ?
Økonomi- lokal eller global ?
Klima påvirkning, attributional eller konsekvens ?

DAIRYMAN; HVILKE INDIKATORER

Økonomi	Miljø	Social
indtægt per kg mælk	N balance per kg mælk og per ha	Uddanelse
indtægt per FAK	N effektivitet	Arbejds miljø
bedrifts resultat	P balande per kg mælk og per ha	Bedrifts kontinuitet
Afhængighed af tilskud	P effektivitet	Sociale forhold og samfundsbillede
Følsomhed for prisfald	Miljø tilskud	
	GHG emissioner	

Væ gtning

Princip: væ gtning økonomi 100%
miljø 100%
social 100%

VÆGTNING

Økonomi	vægt	Miljø	vægt	Social	vægt
indtægt per kg mælk	16	N balance per kg mælk og per ha	15_11	Uddanelse	22
indtægt per FAK	34	N effektivitet	13	Arbejds miljø	42
bedrifts resultat	22	P balande per kg mælk og per ha	11_8	Bedrifts kontinuitet	16
Afhængighed af tilskud	10	P effektivitet	10	Sociale forhold og samfundsbillede	20
Følsomhed for prisfald	18	Miljø tilskud	10		
		GHG emissioner	22		
	100		100		100

AGM, NÆSTE SKRIDT

Fx.

Ud fra nationale evalueringer (focus grupper) vurderes der hvor meget hver indikator skal tælle.

Reference værdier per land skal vurderes.

HVORDAN KUNNE DET BRUGES I PRAKSIS

Anvendt bæredygtighed.

Evaluering i forhold til reference værdier – RISE og andre

Kritiske Måle Parametre - agrotech, dansk kvæg

Dashboard – Australian Farm dashboard

Sustainability Dashboard

To match the Dashboard dials with the dial descriptions refer to "Unpacking the Dashboard" on pages 6–7

Environmental

5 NUTRIENT BUDGET (P)
0
kg/Ha

3 BIODIVERSITY

1 GROUND COVER

2 SOIL STATUS
% of target

6 WATER BUDGET

4 WATER USE EFFICIENCY

8 PLANNING & PRACTICES

9 ISSUE – REVEGETATION

Social

10 PERSONAL BUSINESS HAPPINESS

11 COMMUNITY HAPPINESS

12 STAFF HAPPINESS

7 NET GREENHOUSE GAS
0
$t\ CO_2$

13 STAFF EMPLOYMENT
3
Average years employed

Financial

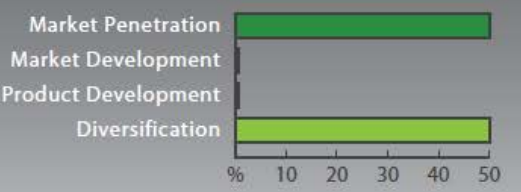
15 OPERATING PROFIT MARGIN

14 GROSS MARGIN
173
$/Ha/100mm

16 ROAM

18 INTEREST COVERAGE RATIO

19 BUSINESS STRATEGY



17 CAPITAL APPRECIATION
11
% pa


Tak for opmærksomheden
Tilbage til arbejdspladsen