Measurement of Sustainability

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01 Who is DINAK?

02 What is sustainability and why is it important to measure the degree of sustainability in the farming business?

03 Introduction to the measurement methods

Deutsches Institut für Nachhaltige Agrarkultur - DINAK

DINAK – the German Institute for Sustainable Agriculture – is …

- a sustainability assessment organisation for agricultural primary production
- a joint venture between INL and IAK, two consulting companies well established in the market

DINAK applies scientifically sound and transparently documented methods to assess sustainability and provides tools for their optimisation.

INL

- Spin-off from University of Halle-Wittenberg (2009)
- Engineering company for the assessment of ecological sustainability and implementation of research projects
- Currently with about 10 employees

Providing the know-how for ecological sustainability assessment.

IAK AGRAR CONSULTING

- Agricultural consulting company
- Active in the German domestic market as well as in the international consulting business abroad
- Founded in 1981
- Currently with about 30 employees plus project-related staff abroad

Providing the know-how for economic and social sustainability assessment. Marketing & Sales for DINAK.

What does sustainability mean? What is sustainable?

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- Use of the term "sustainability" for the first time 300 years ago by **Hans Carl von Carlowitz, 1713:** forester who wanted to create a stable equilibrium in his forest.

- **Brundtland Report 1987**: Commission founded by the United Nations (UN) with the task of working out long-term perspectives for a development policy that is at the same time environmentally friendly: *„Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.“*

- **AGENDA 2030 – 17 UN Sustainable Development Goals** (SDGs): UN General Assembly 2015

17 UN Sustainability Development Goals

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Source: United Nations

Why measuring the degree of sustainability in agriculture?

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- Farming has a huge impact on the environment in the world.
- We need to increase the degree of sustainability to have produce enough food to feed the world, today and tomorrow.
- Key is the measurement – you can only manage what you do measure!

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SUSTAINABILITY

Ecology	Economy	Society
Soil erosion	Exhaustion of long-term debt service limit	Wages and salaries
Humus balance	Cash flow margin	Working hours
Phosphorus balance	Return on equity	Education and training
Nitrogen balance	Return on assets	Proportion of women
Crop protection intensity	Relat. factor income	Gender equality
Greenhouse gas balance	Net investments	Holidays taken
Biodiversity potential	Equity ratio	Age structure
N-efficiency in animal feeding	Profit rate	Occupational health and safety
P-efficiency in animal feeding	Risk management	Social engagement
Animal welfare	Compliance	

Conditions for indicators

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- **Reproducibility:** Indicators should be based on high-quality statistical data that allow for temporal and spatial differentiation.
- **Reasonable cost-benefit ratio:** Data collection should have a reasonable cost-benefit ratio in relation to the objective, which is possible through collection or derivation from existing data sources.
- **Responsiveness of the indicator to changes in behaviour:** Indicators should correlate with current activities and be able to map changes in practices and activity patterns. In the agricultural context, for example, they must be able to respond to changes in cultivation techniques.
- **Methodological validation:** Indicators should correspond to the state-of-the-art of scientific knowledge, be based on recognised survey and evaluation methods and have a method for interpretation.
- **Policy relevance and user friendliness:** An indicator can only be used successfully if there is a correlation to the environmental problem and if the parameters used are politically and socially comprehensible and can be interpreted logically.
- **Suitability as an "adjusting screw":** Clear evaluation functions and threshold values must be available. Indicators should be usable for international comparison and offer the possibility of aggregation.

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Ecological indicator – **Humus balance**

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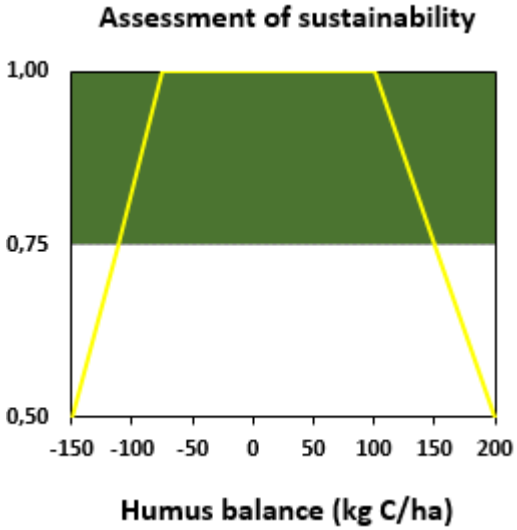
- Complex influence on nearly all soil properties and functions by soil organic matter (securing yields, control of carbon and nitrogen turnover, basis of life for organisms in and on the soil).
- Calculation:

$$Humus\ balance\ (kg\ \frac{C}{ha}) = humus\ net\ demand + humus\ substitution\ by\ organic\ fertiliser$$

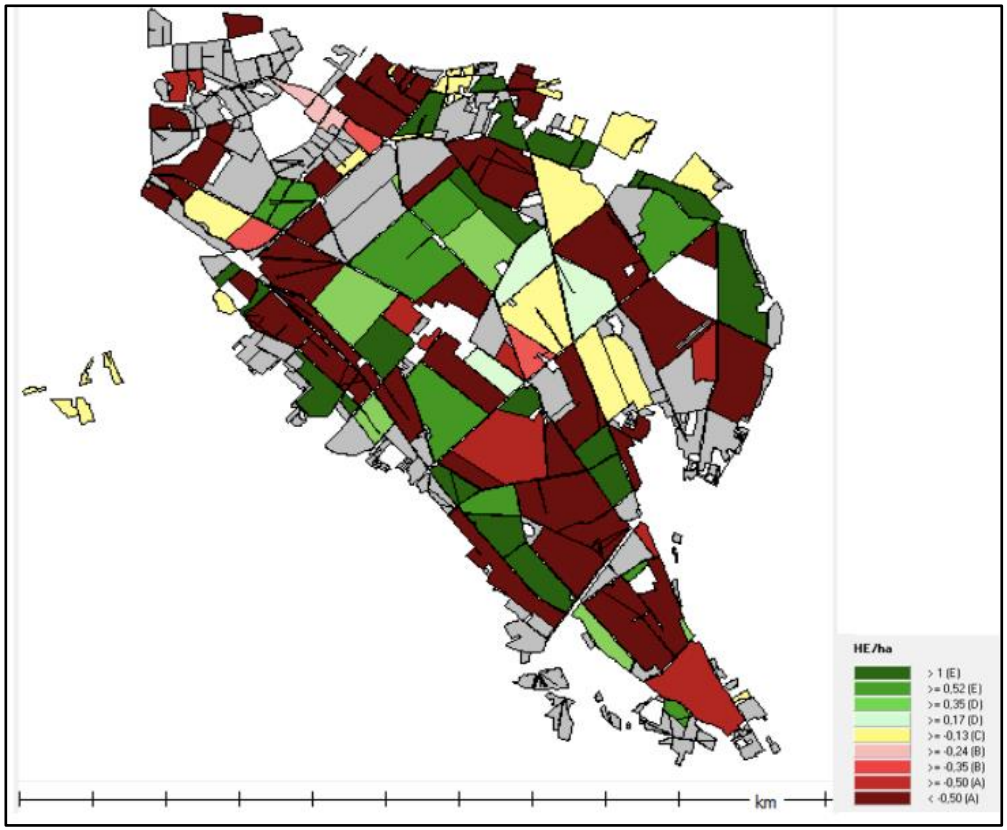
- Assessment according to VDLUFA classification

Definition	Assessment	
< -150	not sustainable	0
-150 - -113	not sustainable	0.5
-112 - -76	sustainable	0.75
-75 - 100	sustainable	1
101 - 149	sustainable	0.75
150 - 200	not sustainable	0.5
> 200	not sustainable	0



Ecological indicator – **Humus balance**

All ecological indicators are determined on a field-specific or sub-plot-specific basis.



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Ecological indicator – **GHG balance**

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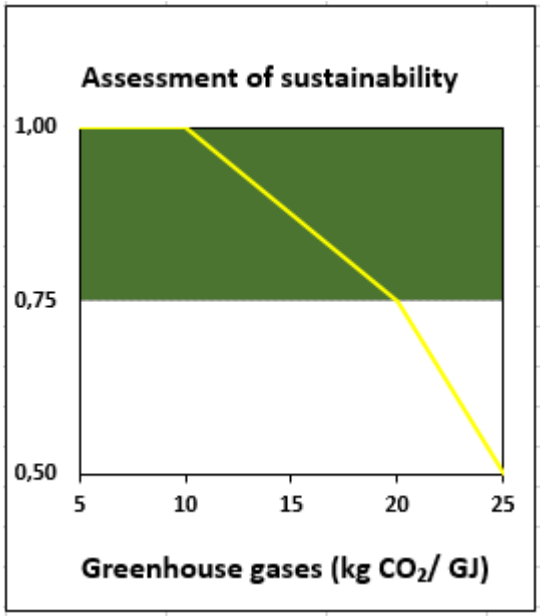
- *Carbon footprint* = Balancing of the climate impact of production processes (direct and indirect), output according to their effect in so-called CO_2 equivalents.
- Federal Climate Change Act (since 12.12.2019, KSG) with the target for greenhouse gas neutrality for Germany by 2050
- Declaration of the greenhouse gas potential for the entire farm or also for individual production sectors (GHG crop production, GHG livestock production)

Definition	Assessment	
< 10	sustainable	1
10 - 20	sustainable	0.75
21 - 25	not sustainable	0.5
> 25	not sustainable	0



Ecological indicator – **GHG balance**

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→ *Crop production*

Aug	Sep	Okt	Nov	Dez	Jan	Feb	Mrz	Apr	Mai	Jun	Jul	Aug

Boden-bearbeitung | Saatbett-bereitung | Aussaat | Düngung | Pflanzenschutz | Ernte, Transport

Diesel	l/ha	25,2	7,0	3,4	2,0	1,7	2,0	2,0	1,7	22,6	17,1	84,7
direkte Energie	GJ/ha	1,00	0,28	0,13	0,08	0,07	0,08	0,08	0,07	0,90	0,68	3,37
CO_2-Emissionen	kg CO_2/ha	75	21	10	6	5	6	6	5	67	51	252
Investitionsgüter												
indirekte Energie	GJ/ha	0,18	0,07	0,05	0,04	0,03	0,04	0,04	0,03	0,53	0,19	1,20
CO_2-Emissionen	kg CO_2/ha	7,9	2,9	1,9	1,8	1,7	1,8	1,8	1,7	23,3	8,4	53,2
Betriebsmittel	kg/ha			230	50,0	4,0	60,0	40,0	1,5			
indirekte Energie	GJ/ha			1,27	1,77	1,15	2,12	1,41	0,29			8,01
CO_2-Emissionen	kg CO_2/ha			127	102	80	123	82	21			535

∑ 12,58 GJ/ha; 840 kg CO2 eq/ha

Ecological indicator – **GHG balance**

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→ *Milk production*

- Ratio of total climate-relevant emission to edible protein (eP) produced within one year

$$
\begin{aligned}
GHG\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) &= GHG\ fodder\ production\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) \\
&+ GHG\ \ housing\ system\ (stable/storage)\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) \\
&+ GHG\ \ direct\ energy\ (electricity/water)\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) \\
&+ GHG\ \ methane\ (digestion/storage)\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) \\
&+ GHG\ \ laughing\ gas_{\ direct}(storage)\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right) \\
&+ GHG\ \ laughing\ gas_{\ indirect}(stable/storage)\left(\frac{kg\ CO_{2eq}}{kg\ eP}\right)
\end{aligned}
$$

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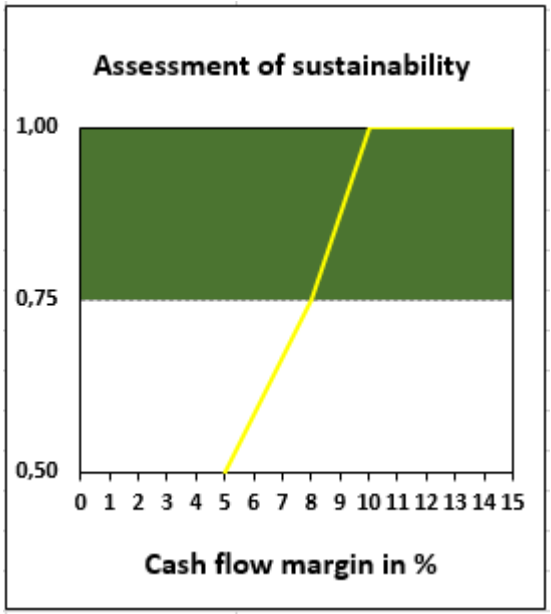
Economic indicator – **Cash flow margin**

- Key figure for the internal financing power of a company, i.e. how many percent of turnover can be used as cash flow for dividend payment or additional investments.

- Calculation:

$$Cash\ flow\ margin\ (\%) = \frac{Cash\ flow\ III\ \times\ 100}{Sales\ revenues}$$

Definition	Assessment	
10%	sustainable	1
8%	sustainable	0.75
5%	not sustainable	0.5
0%	not sustainable	0



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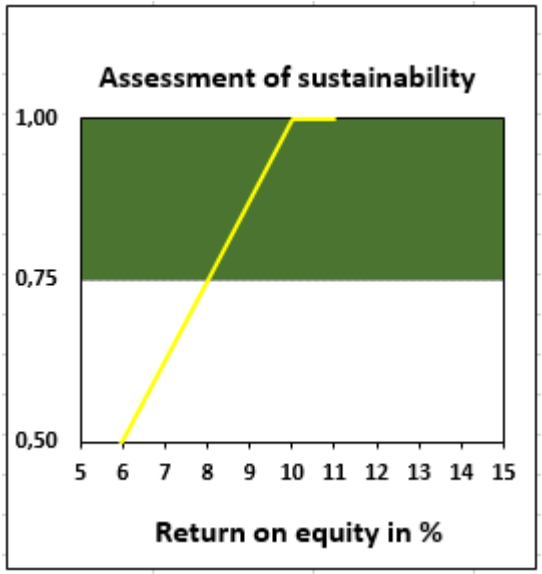
Economic indicator – **Return on equity**

- Benchmark for the interest on the equity capital used in the company.
- Calculation:

$$Return\ on\ equity\ (\%) = \frac{Annual\ net\ profit\ after\ taxes\ \times 100}{Equity}$$

Definition	Assessment	
10%	sustainable	1
8%	sustainable	0.75
6%	not sustainable	0.5
0%	not sustainable	0



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Social Indicator – **Education and training**

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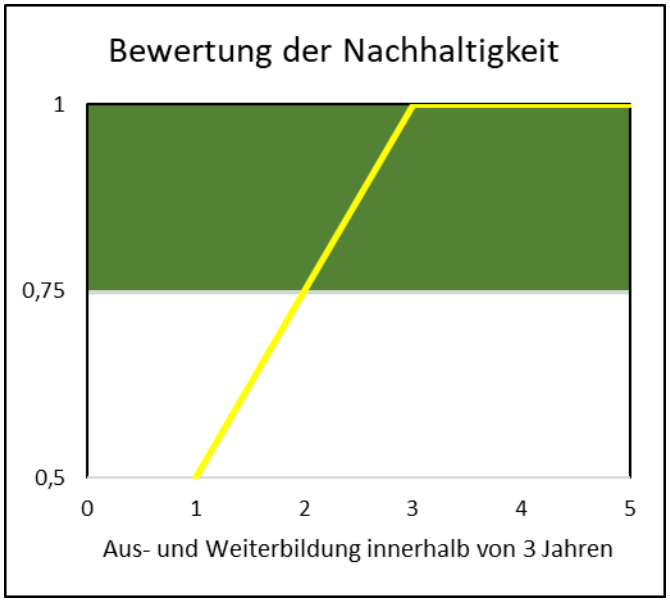
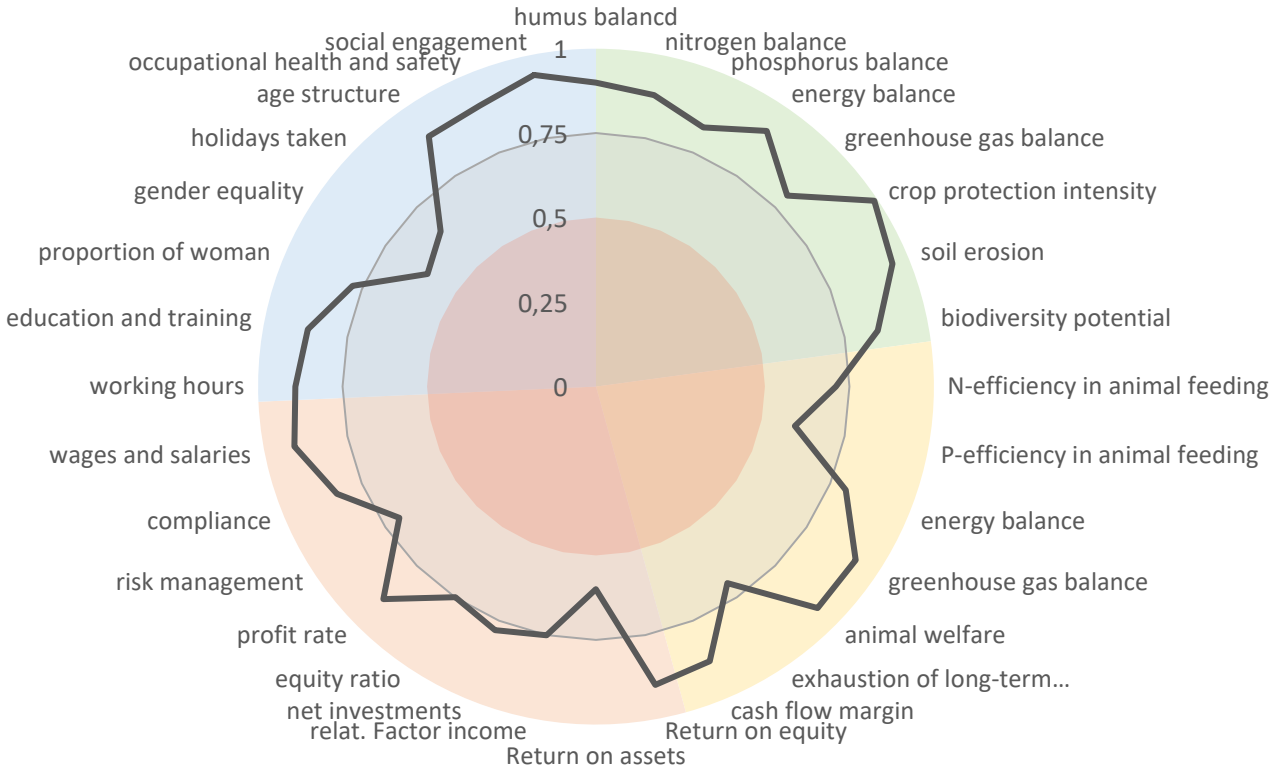
- Adaptation of qualifications to technological and scientific developments, career opportunities
- Average of training measures across all employees over a period of 3 years, weighted by factor
- Attendance confirmations/lists, certificates, receipts

Definition	Bewertung	
3	nachhaltig	1
2	nachhaltig	0,75
1	nicht nachhaltig	0,5
0	nicht nachhaltig	0



Summary of the results – **sustainability analyses**



Summary

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- The degree of sustainability of a farming product or the entire farming business can be measured on a objective way with a set of indicators.

- What was measured can be constantly managed (improved).

- Sustainability measurements delivers also a tool for *product differentiation* along the value chain up to the customer.