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Evaluation of the sustainability of farms

Despite constantly changing challenges in daily politics, the farmer as an entrepreneur is confronted with the task of not losing sight of the long-term development of his operation. "Sustainable development" means that soil, air, water, and the biosphere as natural resources are not overtaxed and that the working conditions remain attractive while economic success is secured.

Meanwhile, several evaluation systems are available which can measure and assess sustainability with its ecological, social, and economic aspects at the farm level.

How is it possible to determine whether a farm works sustainably from an ecological, economic, and social viewpoint? Since around 1990, several evaluation approaches have been developed which pursue the goal of examining and evaluating farms with regard to the effects of agricultural production on the environment. Studies providing an overview of systems for environmental management and environmental examination are available from [1] (a comparison of INDIGO (France), KUL/USL, REPRO (Germany), and SALCA (Switzerland) on the basis of practical applications) and [2] (the farm evaluation systems KUL, REPRO as well as the land use models Pro-Land / ANIMO, RAUMIS, MODAM).

However, sustainability is more than environmental compatibility. The farm evaluation systems RISE, KSNL, and REPRO, which are described below, are currently the only evaluation systems available in German which can assess sustainability with its ecological, economic, and social components at the level of the individual farm and are ready for practical application given the status of their development.

A KTBL working group is currently preparing a comparative evaluation of these systems. The results will be published in the autumn of 2008.

RISE – Response-inducing sustainability evaluation

The measure-oriented sustainability analysis system RISE is a computer-based tool for the examination of the sustainability of agricultural production. The Swiss College of Agriculture developed RISE as of 1999 because it had received requests from private companies to analyze the sustainability of large and small farms in Brazil and China [3; 4].

The objective was to present a simple, low-cost management system for the food sector (organizations of producers, branches of industry, processing operations / trade) and farmers which allows the sustainability of agricultural production systems to be analyzed. As a measure-oriented tool, it also provides a basis for the planning of improvement measures. RISE not only makes a diagnosis, but it is also intended to initiate changes in order to improve sustainability at the farm level. RISE does not give any "recipe-like recommendations" for concrete, clearly defined measures. Instead, it uses a sustainability polygon to show where action must be taken in order to overcome weaknesses in sustainability as efficiently as possible.

The application of RISE also pursues the objective of spreading the philosophy of sustainable production among producers and other links of the value-added chain. As compared with other sustainability analyses, RISE particularly emphasizes worldwide applicability. RISE clearly focuses on cooperation with farmers. Therefore, it is not designed for the control of product quality and certification.

Worldwide applicability and comparability result in a certain simplicity of methods, low requirements with regard to a pre-defined kind and structure of data needed, and far-reaching standardization. RISE uses 12 indicators to evaluate sustainability (*Table 1*), which are calculated based on different parameters. A sustainability index for the entire farm is not striven for because such an index does not permit a differentiated evaluation and cannot show goal conflicts.

Table 1: Indicators of RISE [4]

Area	Indicator
Ecology – *natural resources*	Energy, water, soil, biodiversity
Ecology – *resource management*	Emission potential (N, P), plant protection, waste
Economy	Economic stability, economic efficiency, *local economy*
Social matters	*local economy*, working conditions, social security

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Literature

Literature references are available under LT 08514 via internet (www.landtechnik-net.de/literatur.htm)

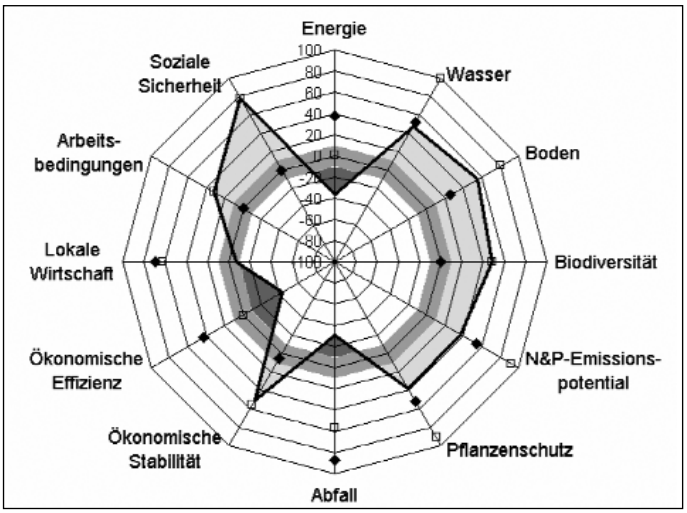


Fig. 1: Results of a RISE assessment, based on twelfe indicators

Data from the farmer are collected in an interview using a 20 page questionnaire concerning the different areas. Some indicators require secondary data of the region, such as climate and crop data, regional wages and costs of living, which are determined regionally before the beginning of an analysis. The feedback of the analysis results is based on the standard output. Strengths and weaknesses are identified in cooperation with the farmer, and starting points for improvements are determined (basic counselling). For detailed counselling, competent local service providers must be consulted.

The degree of sustainability of the individual indicators is shown as a sustainability polygon with 12 corners in a net diagram (*Fig. 1*), in which the strengths (NG > 10) and weaknesses (NG < 10) of the farm are marked by means of colours.

So far, RISE has been applied on approximately 250 farms worldwide (in 15 countries) with various production structures under different conditions. In cooperation with different partners, a more advanced tool based on RISE is currently being developed (c-RISE), which determines the sustainability of the entire value-added chain.

KSNL – System of criteria for sustainable agriculture

The starting point of KSNL was the system "Criteria of environmentally compatible agriculture" (KUL), which was presented for the first time by the Thuringian State Institute of Agriculture (TLL) in Jena in 1994. On this basis, the "System of criteria for sustainable agriculture" was introduced in the year 2000 [5; 6]. It includes the criteria systems KUL, KWL (criteria of economically compatible agriculture) and KSL (criteria of socially compatible agriculture). The sustainability of farms is determined using a total of 34 examination criteria (14 from KUL, 11 from KWL, 9 from KSL) [7] (*Table 2*). The individual criteria are deliberately not weighted and aggregated into an overall sustainability score.

Table 2: Criteria and indicators of KSNL [7]

	Category	Criterion
Ecology (KUL)	Nutrient balance	N-area balance, NH_3 emission, P-balance, soil pH-class, humus balance
	Soil protection	Erosion disposition, susceptibility to compaction
	Plant protection	Intensity of plant protection
	Diversity of landscape and species	Share of important areas under the aspects of ecology and landscape management, median field size
	Energy balance	Energy balance of the farm and of arable farming
	Greenhouse gas emissions (GG)	Specific GG emission
Social conditions (KSL)	Occupation (extent, structure)	Work place supply, age structure, share of women, qualification
	Conditions of occupation	Vacation, working conditions, gross wage level
	Participation	Social activities, share ownership
Economy (KWL)	Profitability	Efficiency ratio, return on total assets, equity return, relative factor payments
	Liquidity	Capital service capacity, cash flow
	Stability	Equity ratio, equity fluctuation, net investments
	Value added	Available income per worker, income of the operation

The first step in the analysis is data collection on the farm. In the ecological area, data are collected by the farm managers themselves using a questionnaire and checked for plausibility by the project office during evaluation. Data collection is mainly based on provable data, and the data (except for KWL) are generally evaluated externally by the central, independent project office at the Association for Agricultural Research and Training (VAFB) in Jena in order to guarantee the neutral, objective evaluation and assessment of data from all of Germany. KWL uses standardized calculation algorithms which are evaluated by accounting agencies and in test and subsidy accounting. For the collection of socially relevant data, the farmer fills out a questionnaire using the available documentation and statistics (e.g. wage accounting, vacation files, inspection reports of the employers´ liability insurance associations).

As an evaluation result, the farm receives

- a documentation in the form of tables which understandably explains the determination of the value of every individual criterion and its evaluation;
- a graphic representation of the results which illustrates the strengths and weaknesses of the farm at first glance;
- an evaluation and interpretation report which names the reasons for detected shortcomings and proposes effective countermeasures.

The 34 test criteria of KSNL are subject to standardized evaluation based on tolerance scales (*Fig. 2*) which mark the range between an optimum to be striven for (score 1) and a just bearable condition (score 6). If the tolerance limit is exceeded (score 6), this shows that development is no longer sustainable with regard to this specific criterion.

The KUL criteria have been tested in practice on more than 400 farms in all of Germany. The complete KSNL has so far been tested comprehensively and optimized on 12 TLL reference farms in a three-year cycle. Based on the KUL procedure, the organization "Environmental Protection in Agriculture" of the VDLUFA can provide certification. Thus far, more than 40 farms from 9 federal states have received the USL certificate "Environmentally compatible farming". Currently, the development of a KSNL certificate "Sustainable farming" is underway and will be completed shortly.

DLG certification system "Future-oriented sustainable agriculture"

The DLG certification system (CS) "Future-oriented sustainable agriculture" has been developed by the DLG in cooperation with the Technical University of Munich, Martin-

Luther University (MLU) Halle-Wittenberg, and the Institute for Sustainable Agriculture in Halle. Especially the ecological part of the sustainability evaluation system is based on the PC program REPRO, a multiple-module model, which was originally developed for the balancing of agricultural material cycles at the farm level by the Institute of Arable Farming of MLU Halle since around 1990 [8; 9]. The farms are certified according to the DLG sustainability standard (indicators and targets) [10].

From the viewpoint of the DLG, the main purpose of the DLG-CS is the optimization of farms under sustainability aspects as well as the promotion of sustainable development in the value-added chain. The focus is also on the application of a slightly modified system to complete value-added chains. Currently, the system is being implemented for the value-added chain grain / bread / bakery products.

For sustainability analysis, a set of approximately 23 indicators from the areas of ecology, economy, and social matters is used, which represents a balance of the value added and the environmental and social effects of the farm (*Table 3*).

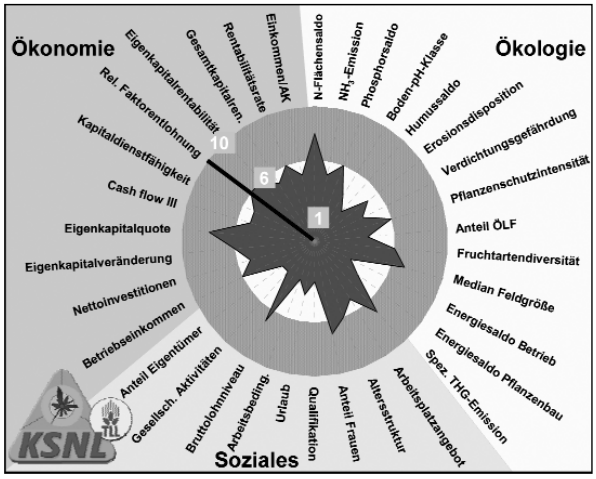
The basis of the system is the data base program REPRO including the GIS module. This model approach provides the most complete possible recording and modelling of the entire farm. Therefore, all data in arable farming are recorded at the field (or field section) level or imported from field files. Since resolution is often fine enough to allow individual sections of fields to be distinguished, the system can also be used for the identification of problem areas.

The sustainability of farming is evaluated by independent service providers. The auditors examine whether the operational values meet the targets and determine the sustainability profile of the farm. The locational data (precipitation, soil number) and the workstep-related cultivation data of the past three farming years provide the data basis for sustainability analysis. Data collection on the farm is carried out by a service provider in cooperation with the farm manager. If digital filed files are available, cultivation data can be transferred to the environmental and farm management system REPRO via interfaces. For the collection of the data required for socio-economic evaluation, the farm manager supplies the annual financial statement of the operation established according to the method approved by the Federal Ministry of Food, Agriculture and Consumer Protection and fills out a questionnaire in cooperation with a service provider.

In the DLG certification procedure, the indicators are linked to provide an overall evaluation of the farm. For overall assessment, the standardized indicator values within the individual columns (ecology, economy, and social matters) are aggregated into one value, the so-called partial index. Every indicator as well as every one of the three partial indices and the overall index can assume a value between 0 (not sustainable) and 1 (sustainable). The three columns of sustainability are weighted evenly. Deficits of individual indicators within one column can be compensated for by other indicators in the same column. However, deficits in one column cannot be compensated for by other columns (concept of strong sustainability). If minimum requirements are met in every one of the individual columns, this is considered "sustainable". The current "sustainability limit" for each of the 3 partial indices is 0.75.

The certificate is granted if the farm fulfils the legal requirements, assures quality in production, and reaches the target value ranges of the three sustainability columns. The requirements of operational quality assurance are met, for example, if a recognized quality assurance system is used. A repeat examination including sustainability auditing and certificate renewal takes place after a three-year period.

Fig. 2: Results of a KSNL assessment



The DLG as the system carrier is responsible for the organization of the operational evaluation procedure. The DLG-CS is checked by means of independent operational audits based on the European standard DIN EN 45011 (ISO/IEC Guide 65). In addition, later recognition as an RAL quality mark is being striven for. The examined object is the individual farm.

The test phase of the sustainability evaluation system, which was largely completed in the middle of 2008, included 90 farms, of which 30 were located in Bavaria and 60 in the north-east and north-west of Germany. Meanwhile, 7 farms have successfully completed the certification procedure and received the DLG certificate in June 2008.

Table 3: Indicators of the DLG certification system

	Range of analysis	Indicators
Ecology	Climatic effects	Greenhouse gas emission
	Resource protection	Energy intensity, corrected P-balance
	Biodiversity	Agricultural diversity, landscape care services, intensity of plant protection
	Soil protection	Harmful soil compaction, water erosion,humus balance
	Water and air pollution	N-balance
Economy	Profitability	Operational income, factor payments
	Liquidity	Exhaustion of the capital service limit
	Stability	Profit ratio, net investments, equity fluctuation
Social conditions	Work and occupation	Wage and salary, average work time, vacation, training and continuing education, work safety, support for employees´ interests
	Social commitment	Social, regional commitment and public relations

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