Strategies for Sustainability in Agriculture from an Economic Point of View

By Christian Noell

Preface

Following the publication “Indicators for a Sustainable Development in Agriculture", this English summary of a comprehensive scientific study is the second brochure that has jointly been published by the European Initiative for Sustainable Development in Agriculture (EISA), Bonn, and the Institute for Agriculture and Environment (ilu), also in Bonn. EISA and ilu have decided to publish this summary of the German study "Nachhaltigkeitsstrategien der Landwirtschaft aus okonomischer Sicht", as such a comparative approach to "Strategies for Sustainability in Agriculture from an Economic Point of View" has not been available before.

The study reveals that the production systems "conventional agriculture" (synonym: agriculture according to the rules), "integrated farming", "ecological farming" and "biodynamic farming" are strongly determined by the underlying economic understanding of the handling of natural resources (= natural capital). The decisive question is: to which extent will the use and consumption of natural capital be Sustainable, if adequate amounts of man-made goods and values (artificial capital) are generated instead.

In how far such a transfer of (natural into artificial) capital is acceptable can hardly be judged with today's knowledge. Such a judgement would need an evaluate on covering very long periods of time. According to the author of this study, therefore neither the pessimistic assumptions of ecological economics nor the more optimistic suppositions of neo-classic economics can exclusively be rated right or wrong.

New publications on the "real state of the world" as the one by LOMBORG quoted in the long version of this study, are discussed very critically: On the one hand there is prove that negative predictions of the Club of Rome for instance have not come true. On the other hand there is no prove that some of these predictions have only failed to come true because - due to the warnings given by the Club of Rome - patterns and strategies of behaviour have been changed.

Seemingly, there is no single strategy towards the Sustainable use of natural re sources which suits all farmers, farms, regions or purposes. An "integrated approach towards sustainability" as suggested by the author seems to be more promising. However, one prerequisite for such an overall integrated approach is the mutual understanding of the different strategies and their underlying economic points of view as presented in this executive summary.

Executive Summary

All agricultural production models discussed here pursue the sustainability objectives as formulated - for example - by the Brundtland Commission. In their basic assumptions, their sustainability strategies can all be described as "strongly sustainable".

The sustainability strategies of the agricultural production models are complementary; together they meet the requirements of sustainable land use under all conditions.

Does agriculture have to become more sustainable?

From an economic point of view, conventional agriculture, integrated farming, ecological farming, and biodynamic farming are the most important agricultural production models, albeit with varying degrees of implementation in agricultural practice. The German term "OrdnungsgemaBe Landwirtschaft" meaning "agriculture according to the rules", is translated as "conventional agriculture" in this English summary. This translation implies, however, that "conventional agriculture" is no static production system but changes and develops according to legislative requirements. The four production systems stand for different strategies of "sustainability" or "sustainable development". The latter terms are social science concepts that integrate interactions and mutual influences of the natural foundations of life, these foundations' long-term availability, and of social development into one approach with ecological, economic and social dimensions.

With Agenda 21 and numerous other initiatives, sustainability considerations have largely entered the discussion on sound economic and social development. Agricultural production, too, is increasingly - and critically - being judged by its contribution to sustainable development. After a flood of definitions contributed, with varying degrees of success, to clarifying the understanding of sustainability in the past decade, today's efforts focus on the implementation at the farm level, in food production chains, or at the higher regional level. The principles guiding the implementation process often have a strong environmental bias; sometimes "sustainability" is even used synonymously with "environmental friendliness" or "nature protection". With reference to agriculture, this is not wholly unjustified because agriculture's specific contribution to sustainable development is made, in the first place, in the ecological field. A closer examination quickly reveals that the relationship between agriculture on the one hand and sustainability and sustainable development on the other is surprisingly complex and comprehensive in so far as:

- All agricultural production models pursue the sustainability objectives as formulated, for example, by the Brundtland Commission.
- The sustainability strategies of these models can all be described, in their basic assumptions, as "strongly sustainable".
- The sustainability strategies of the agricultural production models are complementary; together they meet the requirements of sustainable land use under all conditions.

Agriculture as a whole, within its structured institutional framework, offers a sufficient degree of sustainability, even in its intensive forms. From an economic point of view, crucial importance is to be attached not only to the economic and social dimensions of sustainability, but also to the ecological dimension because the very foundations of human life are decisively determined by the consumption and preservation of natural capital - that is of natural resources and the functions

The starting point of all sustainability concepts is the use of natural capital. A clear distinction is made between renewable and non-renewable natural resources, and the concepts vary with regard to the potential substitutability of the non-renewable natural resources.

Further thought on sustainable development of agriculture - which is confronted with the public sustainability discussion and the predominant form of land use - is necessary. As such it has a major part in managing and generating indispensable foundations of human life.

of nature. In the sustainability strategies of the agricultural production models the economic dimension (typical competitive strategies) is, in addition, closely linked with the respective ecological aspects. A further differentiation of the social dimension of sustainability strategies is not really helpful as, for example the weighing of individual versus collective objectives can be done, by and large independently of a specific production system insofar as the latter is not already established in the ecological and economic dimensions.

The starting point of all sustainability concepts (which are subdivided here into a "neoclassical" and an "ecological" approach) is the use of natural capital A distinction is made between renewable and non-renewable natural resources and the sustainability positions vary, above all, in their views on the conservation and substitutability of important parts of the non-renewable resources. With the emergence of ecological economics and its further development in economic-environmental disciplines, a new scientific approach is available today which tries to mediate between the opposing sustainability positions. Ecological economics expands the objective of environmental and resource economics, which is the optimal consumption of physical and functional natural resources, to include the perspective of considering the interactions between natural and human systems Agriculture works, unlike almost any other sector of the economy at the interface of nature, economy and society. The dynamic approach of ecological economics is therefore very well suited to analysing the prerequisites and the implementation ofsustainable development in agriculture.

As a consequence, new or newly published scientific findings in the field of empirical statistical social research are all the more worth considering They suggest that the threat to the foundations of human life has been highly overestimated in practically all of today's problem areas associated with the protection of nature and the environment, which means that the real state of the world is much better than generally assumed. A crucial insight, in this context, is that agriculture has only a very limited part in today's - to all appearances - comparatively moderate environmental problems. It would certainly be presumptuous to claim that environmental problems and the destruction of nature do not exist; their importance however, seems to have been largely overestimated. The cancer relevance of consumption patterns in industrialised Western countries, for example, is over 30 times higher than that of environmental pollution. At the moment the most reasonable and most urgent contribution to sustainability and sustainable development seems to consist in bringing the "environmental issue" into proportion with other societal problems - in agriculture, too.

Does this mean that we do not need any further discussion on sustainable development in agriculture? This, of course, is not the case because, on the one hand agriculture is inevitably confronted with the public sustainability discussion and' on the other hand, it is the predominant form of land use and, as such, has a major part in managing and generating indispensable foundations of human life In fact, the questions to be asked are the following:

The foundations of sustainability strategies rest on general economic or philosophical and ethical theories, which, in turn, are based on specific value systems and fundamental convictions.

At the level of the practical agricultural model, all sustainability strategies have a mixed theoretical foundation in which neoclassical (optimistic), ecological (pessimistic) and concepts of "safe minimum standards" are represented in different orders of priority.

- How are the sustainability strategies of different agricultural production models to be assessed from an economic point of view?
- In what ways are they different and in what ways complementary?
- What conclusions can be drawn from that for agriculture's future contribution to sustainable development?

Sustainability strategies under scrutiny

To answer these questions, the theoretical background to the practical agricultural sustainability strategies must first be uncovered and traced back to its origins, and its validity and relevance in the individual models must be ascertained. To this end, a three-stage approach proves to be useful because:

- the foundations of sustainability strategies in terms of environmental economics, resource economics and ecology (substitutability of natural capital, intergenerational fairness) rest on
- general economic or philosophical and ethical theories (neoclassical economics, institutional economics, ecological theory) which, in turn, are based on
- specific value systems and fundamental convictions (optimistic, sceptical, pessimistic).

For the purposes of this study, an assessment of specific characteristics of the sustainability strategies has been carried out for all agricultural production models. The comparative survey in table 1 shows:

- At the level of the practical agricultural model, all sustainability strategies have a mixed theoretical foundation in which "neoclassical" and "ecological" sustainability positions and concepts of "safe minimum standards" are represented in different orders of priority.
- In this table, the reliance on the replaceability and restorability (substitutability) of natural capital by human-made capital decreases from left to right, while the importance attached to the absolute preservation of natural capital increases.
- Integrated farming offers, all in all, the best-balanced combination and, consequently, the most responsive, flexible and adaptable sustainability strategy.
- Each sustainability strategy has certain advantages for specific protection needs under different site or environmental conditions.

It can also be seen from this survey that the sharp conflict between the neoclassical and the ecological sustainability positions that often appears in the public sustainability discussion is strongly modified under more realistic economic conditions (institutional economics) and under practical agricultural conditions. In fact, both points of view - which are often, wrongly, described as "weak" and "strong" or even "soft" and "hard" sustainability - are being maintained simultaneously and complementarily, as exemplified in the concept of safe minimum standards. This apparent contradiction can be explained by the fact that, under all agricul-

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Table 1: Characterisation of sustainability strategies in agricultural production models from an economic point of view

Characterisation	Agricultural production models			
	Conventional agriculture	Integrated farming	Ecological farming	Biodynamic farming
Sustainability strategy				
Designation (in this study)	Substitution	Conservation	Limitation	Restriction
General sustainability objectives	●●●	●●●	●●●	●●●
Sustainability position in the model	"strong"	"strong"	"strong"	"strong"
Focus on "[1] neoclassical" sustainability position	●●●	●●	●	▪
Focus on "[2] ecological" sustainability position	●	●●	●●●	●●●
Focus on sustainability concept of safe minimum standards	●●	●●●	●	●
General orientation				
Neoclassical economics	●●●	●●	●	▪
Institutional economics	●	●●	●●●	●
Ecological theory	▪	●	●●	●●●
Environmental orientation				
Resource economics	●●●	●●	●	▪
Environmental economics	●●	●●●	●	▪
Ecological economics	▪	●	●●●	●
Deep ecology	▪	▪	●●	●●●
Environmental management	●●	●●●	●	▪
Material flow management	▪	●	●●●	●●●
Use of natural capital				
Outlook on present and future state of nature and the environment	optimistic	optimistic / sceptical	sceptical / pessimistic	pessimistic
Replacing consumed natural capital by human-made capital	●●●	●●●	●●	●
Saving natural capital for future generation by not consuming it	●	●●	●●●	●●●
Recreating natural capital from spiritual capital	▪	▪	▪	●●●
Optimisation criterion				
Optimal consumption of natural resources	●●●	●●	●●	●
Minimisation of external effects on nature and the environment	●●	●●●	●●●	●●●
Optimisation of interactions between natural and social systems	●	●	●●	●●●
Competitive strategy				
Cost leadership	●●●	●●●	●	●
Quality leadership	●	●●	●●●	●●
Niche strategy	●	●	●●	●●●

Note: Relevance in the model: ●●● = high, ●● = medium, ● = low, ▪ = none
"[1] weak" or "[2] strong" sustainability in the ecological sustainability concept

Integrated farming aims at a degree of preservation and restoration of natural capital that goes far beyond the standards required by law. Much more emphasis than in ecological farming is given to the substitution of (sparingly) consumed natural capital by human-made capital.

Ecological farming subscribes, in large parts, to the pessimistic expectations of the ecological sustainability position. The basic idea is that the substitution of natural by artificial capital must be avoided as far as possible.

tural conditions, natural capital can be replaced to a certain extent by human-made capital and, at the same time, must be absolutely preserved at a minimum level. Another explanation is that neither the optimistic basic assumptions of neo-classical economics with regard to the unlimited substitutability of natural capital nor the pessimistic assumptions of the ecological theory on the conservation of natural capital for future human generations (inter-generational fairness) can be scientifically proved. The "mixing ratio" of both positions in the agricultural production models and in their sustainability strategies is therefore an expression of very reasonable subjective risk attitudes in this respect.

The sustainability strategy of conventional agriculture is a typical substitution strategy. Among the agricultural production systems, it is the one that is most strongly oriented toward resource-economic principles (input orientation) and thus also toward the optimistic economic outlook of the neoclassical school. However, due to agriculture's close integration into an institutional setting in the form of production guidelines (= absolute limitation of the consumption of natural capital), elements of the ecological and the safe minimum standards sustainability concepts can also be attributed to this model which is, consequently, far from pursuing a resource-exploiting strategy.

What is characteristic of the conservation strategy in the sustainability concept of integrated farming is its footing in environmental economics and consequent output orientation (external effects are largely avoided), which manifests itself in appropriate environmental management approaches. The integrated farming model aims at a degree of absolute preservation and restoration of natural capital that goes far beyond the minimum standards required by law. The economic concept of integrated farming may be close to the optimistic economic outlook of the neo-classical school, but is also influenced by the scepticism of institutional economics with regard to the treatment of nature and the environment. There are numerous possible links with ecological economics as well. Integrated farming builds on procedural openness and flexibility. Much more emphasis than in the ecological fanning model is given to the substitution of (sparingly) consumed natural capital by human-made capital.

With its sustainability strategy of limitation, the ecological farming model subscribes, in large parts, to the pessimistic expectations of the ecological sustainability position regarding the irreversible consumption of natural capital: Only by limiting the use of natural capital can its irretrievable loss be prevented. The basic idea is that the substitution of natural by artificial capital must be avoided as far as possible. The focus on the interactions between the farms' natural and their techno-economic subsystems is even stronger than in integrated farming or in conventional agriculture. The guiding economic principles are those of ecological economics and - as the latter's theoretical foundation - institutional economics. The environmental management concept associated with integrated farming is replaced, in this model, by an approach to the life-cycle management of agricultural material that is based on the principles of material flow management. Eco-

The sustainability strategy of biodynamic agriculture contrasts sharply with that of conventional agriculture. The preservation and, if possible, creation (transformation of the spiritual sphere) of natural capital are given top priority.

Even if the production systems' consumption of natural capital were known, their sustainability would be difficult to assess. So far, there has been no systematic definition of their ecological footprints, eco-efficiencies and indices of "weak" or "strong" sustainability.

logical farming refrains from realising full production potentials, because its ecologically oriented production processes must meet pre-determined restrictive standards.

The sustainability strategy of restriction which characterises biodynamic agriculture contrasts sharply with that of conventional agriculture. The pessimism of the (deep) ecological understanding of sustainability fully invades this production model. The preservation and, if possible, creation (transformation from the spiritual sphere) of natural capital are given top priority. Farm-internal material cycles are even more strictly closed than required by ecological farming standards, and the human being, as farmer and consumer, is incorporated into the production cycle. Material flow management principles are implemented to a large extent, but here, just as in the ecological farming model, the life-cycle perspective remains basically limited to the individual farm. In fact, the relevant farming guidelines do not allow nutrients that have been exported from the farm with agricultural products to be re-imported, for example by way of sludge, industrial residues etc. The economic orientation is similar to that of deep ecology but modified, in practice, by irrefutable economic viability requirements.

The "integrated sustainability" model

The observations made so far have shown that, from an economic point of view, the question is definitely not which of the described sustainability strategies is more or less sustainable. For reasons of principle, this can only be evaluated in retrospect and after longer periods of time:

- At the moment, there is no conclusive evidence either for the optimism of neoclassical economics nor for the pessimistic outlook of the ecological theory.
- Even sustainability strategies with a sceptical view of the environment do not build on proven knowledge, but develop from the already mentioned risk-averse expectations.

Even if the different production systems' present consumption of natural capital were known, an assessment would be difficult to make because the long-term rate of irreversible consumption of nature or of non-renewable resources would still not be ascertained. The surface requirements per unit produced in ecological farming systems, for example, are higher than those of integrated farming, and the reduction of biodiversity is lower in biodynamic agriculture than in conventional agriculture. But so far, there has been no systematic definition for all agricultural production models of the ecological footprint, of eco-efficiencies and indices of "weak" or "strong" sustainability calculated on a large geographical scale. And the results would still have to be read with the reservation that they were based on today's assumptions on the substitutability of natural capital. However, future research into the prerequisites for a global concept of sustainable development will have to take up this challenge.

Today's challenge is rather to optimise agriculture's contribution to sustainability and sustainable development than to actually make this contribution. The "integrated sustainability" concept could point the way forward.

Each of the strategies presented above will, under certain conditions, optimally serve the purpose of sustainable development. By combining these strategies, a great variety of differentiated field conditions and requirements can be deduced for the sustainability approaches.

In view of the high sustainability level prevailing in Germany and Europe and the comparatively insignificant general environment and health hazards caused by agriculture, a sustainability concept should be based on

- differentiation instead of generalisation, and
- integration instead of polarisation.

Today's challenge is rather to optimise agriculture's contribution to sustainability and sustainable development than to actually make this contribution. Taking up the idea that agriculture, with its production models and their sustainability strategies, has a fully developed set of instruments to guarantee its own sustainable development, the "integrated sustainability" concept could point the way forward.

The integrated sustainability concept is based on the assumption that each of the strategies presented above will, under certain conditions, optimally serve the purposes of sustainable development. Determinants are, among others, product types, product qualities, site characteristics, services demanded by the general public and sustainability objectives to be attained on a larger geographical scale. By combining these factors and their variations, a great variety of differentiated field conditions and requirements can be deduced for the available sustainability approaches. In a final evaluation from an economic point of view, the following conclusions can be drawn with regard to the sustainability models and production systems that have been discussed in this study:

- Conventional agriculture, which is the implementation of the legal status quo, does not have the "visionary" approach required to further advance sustainable development beyond the level (of good practices) that has already been achieved. In addition, this production system does not optimally meet modern standards of risk prevention with respect to the environment. Thus it has an indisputable - and for the implementation on a large scale very essential - production function. But it cannot be seen as a model to guide future development.
- The integrated farming model, in contrast, offers the potential for further development, also of conventional agriculture and its large-scale implementation. It fulfils the requirements of all three sustainability dimensions in a more balanced way and to a higher degree than any other production system. But the integrated farming model and the appropriate strategies and procedures will still have to be defined more precisely and specified in concrete site- and region-specific approaches. This is the only way to ensure the transparency and comprehensibility that are necessary to achieve wide public acceptance for the purposes of sustainable development.

Ecological and biodynamic farming systems both serve as models for certain market segments, but are not transferable to the entire agricultural sector. Irrespective of the production and product qualities that can actually be achieved in these land use systems, the decisive factor here is the subjective value system and attitude of those consumers who are prepared to pay a higher price for their perception of advantages. In the case of biodynamic farming, it must be added that this production system does not suggest itself as a general model also be-

Competition for the most appropriate sustainability strategy would increase agriculture's contribution to a sustainable development. With a sufficiently clear definition of the quality requirements, the economically most viable production system should establish itself in each case.

cause it would not be able to meet the quantitative requirements of food security on a large scale.

Promoting competition for the most appropriate sustainability strategy in a given situation would, consequently, be the best way to increase agriculture's contribution to sustainable development. In terms of spatial economics, this would result in a mosaic of large and small area units in each of which the most competitive sustainability strategies prevail. With a sufficiently clear definition of the quality requirements of agricultural products - and by-products -, the economically most viable production system should establish itself in each case.

One thing, however, is true for all production systems examined in this study With the introduction and application of indicator systems tailored to the conditions specified above, sustainability - defined as integrated sustainability - could be measured more efficiently and more easily; the major objective of this measurement would be to identify the optimal sustainability strategy in a given context Ecological economics, with its special focus on optimising the interactions between natural and social systems, is much better suited than any other ecoloqical-economic sub-discipline to support the vision of an integrating sustainability and its description by indicators. But even coherent indicator systems for measuring sustainability or sustainable development cannot be profitably employed without profound knowledge of the interactions between the individual indicators

The author:

Prof. Dr. habil. Christian Noell is a graduate agricultural engineer (Diplom-Agraringenieur) with specialisation in plant production. He holds a doctorate and university habilitation as an agro-economist and, in 1999, was made professor by special appointment at the Christian-Albrechts-Universitat in Kiel. In the same year, he was appointed to a chair at the Royal Veterinary and Agricultural University (KVL) in Copenhagen, Denmark. There he works as Associate Professor for Managerial and Production Economics in the Department of Economics and Natural Resources. His present work centres on the economics of sustainable land use systems, the management of nature and the environment, the solution of conflicts in the use of the environment, and the strategic management of food crises.

The study:

This study looks into the question of whether there is, from an economic point of view, a "one and only" correct sustainability concept for the development of agriculture. A characterisation of nature as a factor and a product of land use, of the interactions between nature and the economy, and of the ecological qualities of existing land use systems is followed by an analysis of the criteria for a sustainable use of natural capital. This is complemented by an excursus into the sustainability principles guiding the economic use of nature and resources and the resulting sustainability strategies of different production methods. On this basis, fields of action for sustainable development in agriculture are finally outlined.

The Institute for Agriculture and Environment (ilu):

The Institute for Agriculture and Environment was founded under the roof of the Association for the Promotion of Integrated Farming (FIP) in Bonn in 1997 and today is part of the Association for the Promotion of Sustainable Agriculture (FNL), Bonn. Together with experts from different disciplines of the agricultural and environmental sciences, the collection of data and facts, analyses, consultations and documentations are performed in project teams. The documentation presented here has been published as volume 5/2002 of the ilu-series.

The complete study, the summary of which is presented in this publication, has been published as volume 5/2002 of the ilu-series. This series includes:

Vol 1/1999 Sustainable Agriculture - from the history of ideas to practical application
author: PD Dr. Olaf Christen
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editors: Institute for Agriculture and Environment (ilu),
Dr. Andreas Frangenberg
European Initiative for Sustainable Development in Agriculture (EISA)
KonstantinstraBe 90,
53179 Bonn
Tel: 00 49 (0)2 28 - 9 79 93 0
Fax 00 49 (0)2 28 - 9 79 93 40
(ilu) ilu@fnl.de, http://www.fnl.de/ilu/iluindex.html
(EISA) s.witsch@fnl.de, http://www.sustainable-agriculture.org

author: Prof. Dr. Christian Noell, Royal Veterinary and Agricultural University, Department of Economics and Natural Resources, Frederiksberg / Copenhagen, Denmark

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EISA:

The European Initiative for Sustainable Development in Agriculture (EISA) has been founded in January 2000 by six national organisations from European Countries. EISA members are strongly committed to sustainable agriculture, which is economically viable, environmentally responsible and socially acceptable. EISA members will continue to work in partnership with all stakeholders to achieve this goal through the promotion and further development of Integrated Farming.

The principles and guidelines for Integrated Farming have been laid down in the EISA document "Common Codex for Integrated Farming" (published in January 2000). In this Common Codex, sustainable development and Integrated Farming are described as follows:

. Sustainable development on our planet cannot be achieved without a major contribution from agriculture. People must be fed, and agriculture is faced with the challenge of producing food for a rapidly growing world population whilst maintaining the world's fragile resources. Modern farming systems have evolved to meet this need in a way that combines the essential requirements of profitability and productivity.

. Sustainable development must encompass food production alongside conservation of finite resources and protection of the natural environment so that the needs of people living today can be met without compromising the ability of future generations to meet their own needs.

. Integrated Farming meets these potentially conflicting challenges at farm level, in a manner that balances food production, profitability, safety, animal welfare, social responsibility and environmental care. Integrated Farming seeks to reinforce the positive influences of agricultural production whilst reducing its negative impacts. It is a means of achieving a sustainable agriculture and an indispensable part (but only a part) of sustainable development.

• The Codex defines a set of common principles and practices that will enable farmers and growers to achieve these goals through the promotion and further development of Integrated Farming.