SATHLA Conference Keynote Lecture

THOUGHTS ON SUSTAINABILITY

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Abstract

'Sustainability' has a number of facets such as 'resource sustainability', 'ecological sustainability', 'social sustainability', 'economic
sustainability', requiring support by technological suitability and political stability. All elements are connected with each other; in their application synergetic effects as well as conflicts between the various forms of sustainability may occur. To master the future, a comprehensive revision of policies and practices is necessary to stop the still ongoing increase in material consumption and environmental destruction. The transition to a more sustainable society requires a new way of thinking, putting more emphasis on sufficiency, equity and quality of life.

Introduction

Once upon a time farmers lived in harmony with their environment: They did not use the resources beyond their renewability, they did not destroy their environment. This sounds to me like a fairy tale - farmers in (sub-)tropical areas had to destroy rain forests or burn the savannah before they could start planting their crops. But; of course; their number was small and the destruction brought upon the environment was negligible.

As we are approaching the turn of the second millennium AD; the situation has changed totally: More or less all the arable land of the world is used up, partially by farming, partially by settlements and infrastructural elements. Even marginal lands, which should have been preserved in the natural stage, are already under the plough.
Agriculture became the main consumer of water on a global scale, a major consumer of energy and is responsible for a good share of pollution of air, soil and water, including agents of climate change. Additionally, agriculture mines its own resources: overexploitation of land, spatial extension of cropping and large scale deforestation, together with salination, robs annually large tracks of arable land.

Most of the highlands of the tropics and subtropics were once forested, but after the expansion of the European civilisation into Latin America, Africa and Asia, the area under forest declined tremendously. A good example for the destructive force of the Europeans conquering a tropical country is the story of the deforestation of the Mata Atlantica, which stretches from NE Brazil to Uruguay. The botanists claim, that
the forest here was once one of the richest in the world in regard to the number of species of flora and fauna. Nowadays, only 3-4% of the original forest area is still remaining. Even those few areas have suffered from logging and are deprived of quite a number of species.

Agriculture is doubtless a destructive force, but, of course, we can not do without it. What is to be done? We can not return to the olden days, when „farmers lived in harmony with the environment", we can not significantly increase the area for farming, but we need to produce

more and more food for a growing world population, i.e. we have to intensify the output per unit production area.

Sustainability

The difficult term 'sustainability'

The term 'Sustainability' is now widely used, not only in development circles, but far beyond - even by agronomists. The term itself was rather unknown two or three decades ago, but due to a study by the World Conservation Union (IUCN, 1981) on sustainable resource use , this term became more widely known. From there the concept made its way into the final report of the World Commission for Environment and Development, the 'Brundtland Report' (WCED, 1987). This report made sustainable development the cornerstone of its attempt to reconcile environmental and ecological objectives. Five years later, 'Sustainability' became one of the key terms of the United Nations Conference on Environment and Development (UNCED), also called the 'Rio Conference'. Since the Rio Conference, the biggest gathering of heads of state and government in all human history, it became absolutly essential to include this term in any official speech on development - and in any application for funds directed to international donors.

Sustainability was not invented in the 20th century; it has been „a guideline for human culture from time inmemorial" (von Weizsaecker, et al. 1997). Humankind has, for most of its existence on earth, practised some kind of sustainability without an explicit consciousness of the concept; resource use and population growth remained 'sustainable' until a few thousand years ago without much active intervention.

When we look into the history of the various civilisations of the world in the last seven thousand years, we may distinguish between those who declined due military interventions and those who had to step down because of ecological reasons. Numerous cases are known in which the development of large cities, entailing the necessity to cover the needs of thousands, even tens of thousands of people, put such a stress on the environment, that the civilisation broke down. The native Americans, both in South and North America, had and partially still preserve, a cultural understanding of living with nature without mining it. (The Maya culture might have been an exception.)

The civilisation of (mostly) European conquerors introduced a totally different way of thinking and brought great change. The 'American way of life', reality in a number of industrialised countries, and a dream for billions of people in other countries, culminated from this way of thinking - This is the culmination of unsustainability, too.

This can be proven by a few figures taken from official sources. Statistically an average U.S. American citizen consumes in his/her lifetime
(calculated for 80 years):
200 million liters of water
20 million liters of fuel (gasoline)
10,000 tons of steel
the wood of 1000 trees.

According to Bill Rees, Professor at the University of Vancouver, we would be in need of twenty more planets for resource extraction and disposal of wastes, if all mankind would copy the (U.S.) American lifestyle.

In all civilisations, including the Western, there have been individuals demanding a more sustainable use of resources. In Germany e.g., already in the 12th century A.D., foresters demanded to sustain the use of forests by not cutting more trees than could be regrown on the same track of land. Yet, it took more than 600 years before the idea was put into practise in Central Europe by creating really sustainable forests. This happened only after coal was found in Germany and could replace the wood as energy resource.
After the 'Rio Conference' a number of 'Action Plans for Sustainable Development' were created, quantifying 'sustainable' resource use and recommending actions for a more 'ecologically' oriented development of cities, regions and nations. One of the best elaborated plans of this kind is the 'Action Plan for Sustainable Development of the Netherlands', stating e.g. „5,000 km of air travel can be granted per person, distributed over a period of 10 to 20 years".
Unfortunately, none of those plans were yet put into action.

The Technical Advisory Committee of the Consultative Group on International Agricultural Research (TAC/CGIAR, 1988) states: „Sustainable agriculture is the successful management of resources of agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment, conserving natural resources".

Many other organisations and individuals have formulated their own definitions of sustainability with regard to development and/or agriculture. I will try to define the various aspects of sustainability to give a clearer picture of what sustainability really entails (Fig. 1).

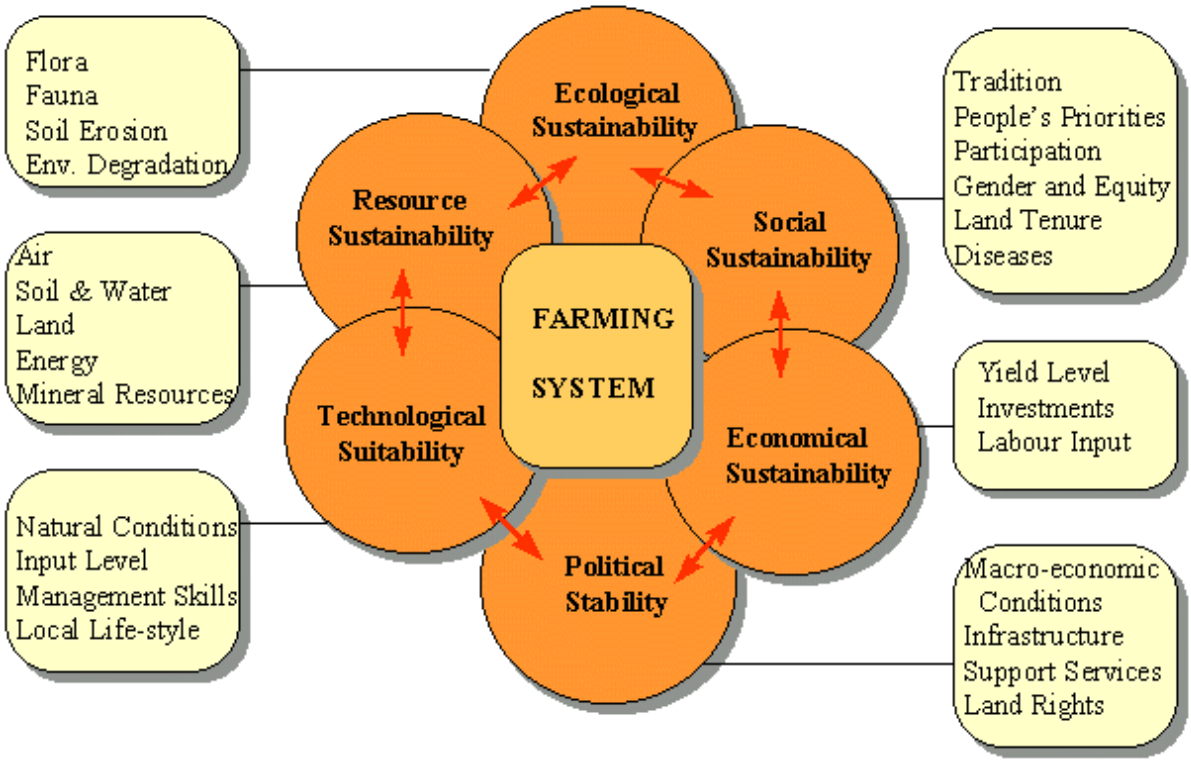

Fig. 1: The various aspects of sustainability

Resource Sustainability

"Within the context of resources ‘sustain’ means to maintain or prolong the productive use of resources and the integrity of the resource base" (Mothadulla et al., 1994). The term ‘resources’ might include natural resources as well as mineral/fossil and genetic resources.

In 1972 a book was published which really shocked the world: ‘The Limits to Growth’, also known as the ‘Meadows’ Study’ (Meadows et al., 1972).. The message of ‘The Limits to Growth’, based on a deliberately simple computer model, was : The resources of the world are limited, the increasing demand for food and industrial output of the steadily growing population will result in increased pollution on one hand and a rapid decline of resources on the other. Doomsday became calculable. Some 9 million copies of this book were sold in 29 languages, awareness was created and action plans worked out. But the impact of the counter actions were not large enough to change the predictions of the ‘standard run’ of the Meadows’ study.

Twenty years later, the Meadows in collaboration with Jorgen Randers, published an update of their book and had to call it ‘Beyond the Limits’ (Meadows et al., 1992). „In 1991, when we looked again at the data, the computer model, and our own experience of the world, we realised that in spite of the world’s improved technologies, the greater awareness, the stronger environmental policies, many resource and pollution flows had grown beyond sustainable limits" (Meadows et al., 1992, Fig. 2). The authors’ prognoses: „Without significant reduction in material and energy flows, there will be in the coming decades an uncontrolled decline in per capita food output, energy use and industrial production."

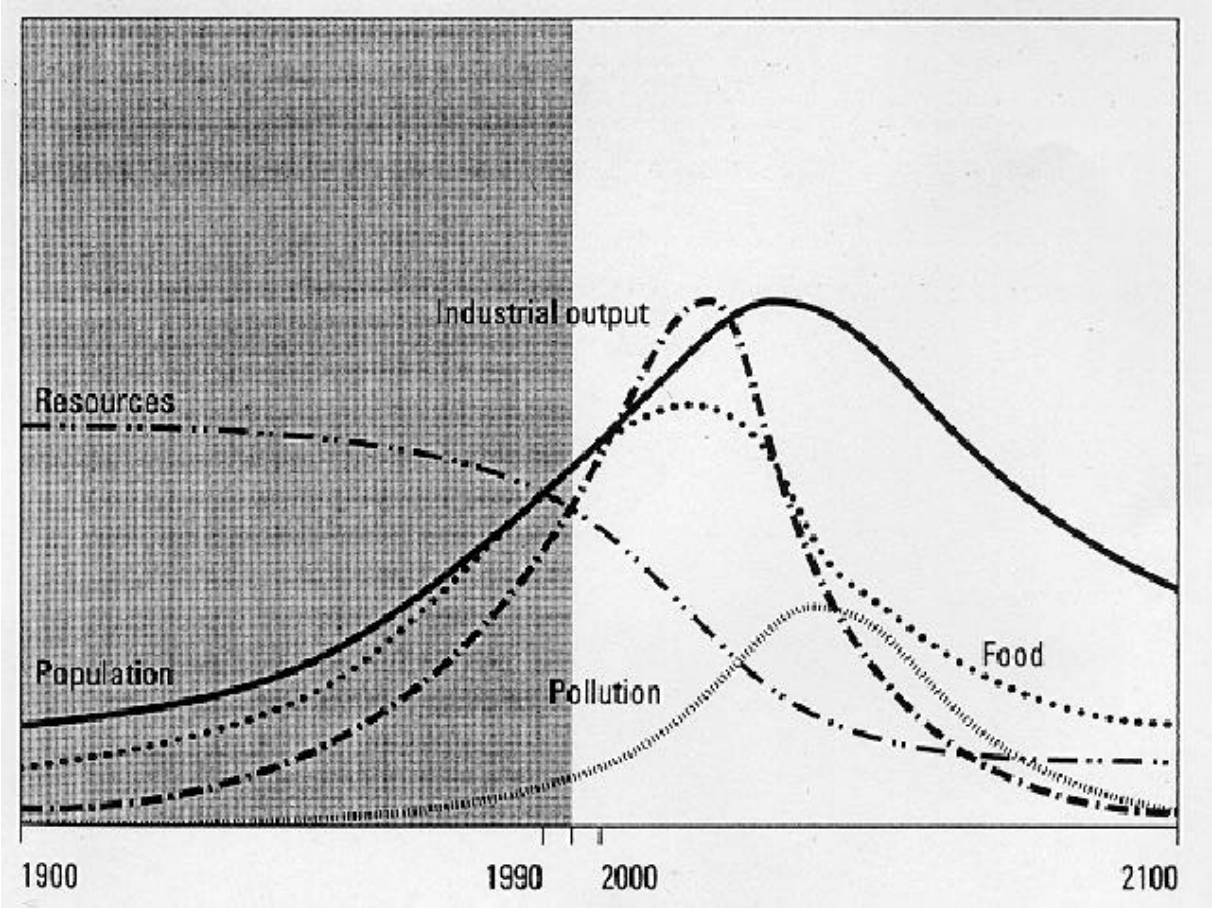

Fig 2: The ‘ Standard Run’ From the ‘Limits to Growth’ (Source: Meadows et al., 1992)

It has to be mentioned however, that the decline is not inevitable; there are chances to escape this fate. One of the measures which should be taken is doubtless the more intelligent use of the available resources as e.g. vividly described in ‘Factor Four - Doubling Wealth - Halving Resource Use’ (von Weizsaecker et al., 1997).

Application of ‘sustainability’ recommendations to agriculture in the tropics and subtropics, requires:

a reduction in the use and/or the pollution of the natural resources (soil, water, air),

a better protection of the environment,

a more efficient use of material and energy,

a substantial reduction in population growth.

But can we feed the growing population with lower quantities of energy-consuming less mineral fertilisers? Can we produce more food with less input of machinery, fossil fuels and lower inputs in agrochemicals?

Is farming possible „while maintaining or enhancing the quality of the environment" and „while conserving natural resources"? How shall we react to Faeth’s statement (Faeth, 1993) „If a production practise takes a resource beyond its ability to replenish itself that use of the resource would be unsustainable"?

Ecological Sustainability

‘Ecological sustainability’ demands „the existence of the ecological conditions necessary to support human life at a specified level of well being through future generations" (Lélé, 1991).

The more intensive any agricultural production is, the more destructive it usually is on flora and fauna of that area. Still, even low input agriculture in rain forest areas e.g. can be extremely destructive and can turn „green hell to red desert". The large areas under low-input pasture e.g. in the Mata Atlantica region of Brazil can not be regarded as very rich in flora and fauna in spite of the low level of production. How can we guarantee a higher level of a ecological well being of a larger number of species in spite of the need to produce more food and fibre per unit land? Is agroforestry a solution? Can less harmful pesticides applied in lower quantities to our crops be helpful to reach our goals?

Grillo Fernandez and Rangifes Vasquez postulate in their book "Agricultura y cultura en el Peru" (1988). "The Andean man and woman see the flora, fauna, soil and water as parts of a whole, of which they and their children are part. „We are part of the Earth".
This relationship does not imply immobility but rather continuous transformation and domestication of the environment, not for the unilateral benefit of man but for the reciprocal benefit of nature and society".
Does this way of thinking and feeling and practising agriculture show us a way out of the dilemma?

Social Sustainability

Social sustainability is defined as „the ability to maintain desired social values, traditions, institutions, cultures or other social characteristics" (Barbier, 1987). Social sustainability within the context of agricultural development should include additional factors like individual welfare, society welfare and equity.

Much of political unrest, especially in Latin America, is due to social inequity and unjust distribution of land. Sustainable agricultural development apparently asks for more equity, more participation, more society welfare. When travelling through Pernambuco State of NE-Brazil with its incredible large sugarcane estates you might feel that 'Social Sustainability' is definitely not practised there. But, the fields under sugarcane monoculture are well maintained and do not show any sign of soil erosion. Some nearby fields of small farmers with a greater variety of crops and higher „social sustainability", on the other hand, might show heavy gullies and other signs of soil erosion. How do we solve conflicts between these various types of sustainability?

Economic Sustainability

Any new technique, any measure proposed for agricultural development in tropical and subtropical highlands has to be economic (in regard to business management). Otherwise, it will not be accepted by the farmers. Even if a new measure fulfils the requirements of all the other above mentioned facets of sustainability - if it is not economically viable, it will be doomed to fail.
On individual farm level problems might arise, too, when introducing new, 'more sustainable' techniques, which decrease e.g. the soil erosion, but with the expense of a higher input in agrochemicals. In our DESUSMO project e.g. we were confronted with an economic study which showed very clearly that the more 'sustainable' cropping techniques were not economic and the most damaging one in ecological terms was economically the most profitable one.

The macro-economic frame conditions, influenced by the state through taxes and regulations, do have a strong impact on the 'economy' on micro scale: If the 'ecological costs' of operations would be regarded as part of the overall budget, and ecologically 'misconduct' be taxed according to the damage caused, the situation would change dramatically.

Technological Suitability

Numerous projects in the tropics and subtropics have failed because the technology used turned out to be unsuitable for the specific conditions of the site where they were applied. This unsuitability can be in regard (1) to the natural conditions, (2) to a too high level of technology (3) to a too high input and management level (often in connection with the former) or (4) to incompatibily with the local life-style.
Within the DESUSMO project we discussed the suitability of oxen for soil tillage to be applied on slopes of 30-60% inclination. From a resource use and ecological point of view this tillage technique is the best one, the yields are acceptable, too. However, the farmers were

not very happy as they regarded the use of draught oxen as an unacceptable, a below-standard level of technology.

Political Stability

Sustainable development needs favourable, stable political and institutional conditions. Stable macro-economic conditions, a well developed infrastructure, government support services, e.g. a functioning extension service, and secure land rights are some of the most important issues in this respect.

Synergy and Conflicts

When developing a new agricultural technique or when changing land use, the above mentioned forms of sustainability will not always be of the
same importance, but all factors are relevant and have to be taken into due consideration. The various forms of sustainability are interrelated with each other, in some cases offering synergetic effects. In other cases they are incompatible with each other and conflicts arise, as pointed out above.

During our work in South America, we experienced in a number of cases the synergetic effects of new interventions, which were not only more ‘sustainable’ in terms of a better protection of the resources and the ecology in general, but also in terms of a higher economic efficiency. One of those examples was the shift from low input-low output pasture to improved types of pasture of higher productivity and with leguminous trees
integrated, a well adapted agro-pastoral system.
When seeking sustainability the number of conflicts between the various facets of sustainability might be larger than the number of synergeticeffects.
A typical example in this respect is the introduction of no-tillage practice which was introduced in a number of countries on a large scale. Soil fertility improved after a while, less energy was used for field preparation, higher yields could be achieved by the farmers, thus satisfying the forms of resource sustainability and economical sustainability, partially also ecological sustainability.Yet it turned out, that after a short period of time the weed growth was so strong, that it could not be controlled by labour only. Herbicides had to be used which after a while contaminated the groundwater heavily. We have to learn from this, that any new invention has to be checked very carefully not only for its immediate effects but also for their first, second and even third order side effects.
Conflicts might also arise when we look at new introductions from different points of view: e.g. of the farmer, the community, the nation or even of the world. The very same applies when trying to satisfy immediate needs and future needs, i.e. using or conserving the resource base for later generations.

In market oriented societies, raising production is often given primary attention in agricultural development. Farmers, consumers and government officials agree in a concerted way, that output has to be increased per unit area and unit input, paying little attention to ‘sustainability’ concerns.
But reality shows, that each ecosystem or agro-ecosystem has an upper limit to its productivity. If this is exceeded, an (agro-)ecosystem will degrade and may eventually collapse, resulting in a smaller number of people being able to survive on the remaining resource base.

Another aspect has to bementioned: Sustainability is never a static concept but always highly dynamic; new concepts have to be found and checked for their sustainability. „Choices must continuously be made in a never-ending search for balance between conflicting interests" (Reijntjes et al., 1992).

Aspects of Implementation

When evaluating a farming system, or when introducing new techniques, a number of sustainability criteria can be applied (Reijntjes et al., 1992, after Gips 1986). Agriculture to be sustainable should be:

· **Ecologically sound:**
The quality of natural resources is maintained and the vitality of the entire agro-ecosystem is enhanced.

· **Economically viable:**
The economic return should cover all the farmers inputs to be attractive enough to be maintained by the farmer. It is desirable to measure
economic viability not only in terms of crop yield or number of animals raised but also in terms of functions such as conserving resources or
minimising risks.

· **Socially just:**
„Resources and power are distributed in such a way that the basic needs of all members of the society are met and their rights to land use,
adequate capital, technical assistance and market opportunities are assured"

Humane:
All forms of live (plant, animal, human) are respected and the spiritual and cultural integrity of the society is accepted and preserved.

· **Adaptable:**
Rural communities are capable of adjusting to the constantly changing conditions for farming.

When looking at a farm as a system, it becomes easily clear that the ratio between input and output is a very important one for deciding upon its economic sustainability. The ratio between natural inputs and external inputs which feed the farm resources gives us an indication of the resource sustainability of this agro-ecosystem called a farm (Fig3).
Nevertheless, ‘Low External Input Agriculture’ can not be the goal, if it is not bound to sustainability Thus the concept of ‘Low External Input Sustainable Agriculture’ (LEISA’) was born (Reijntjes et al., 1992).

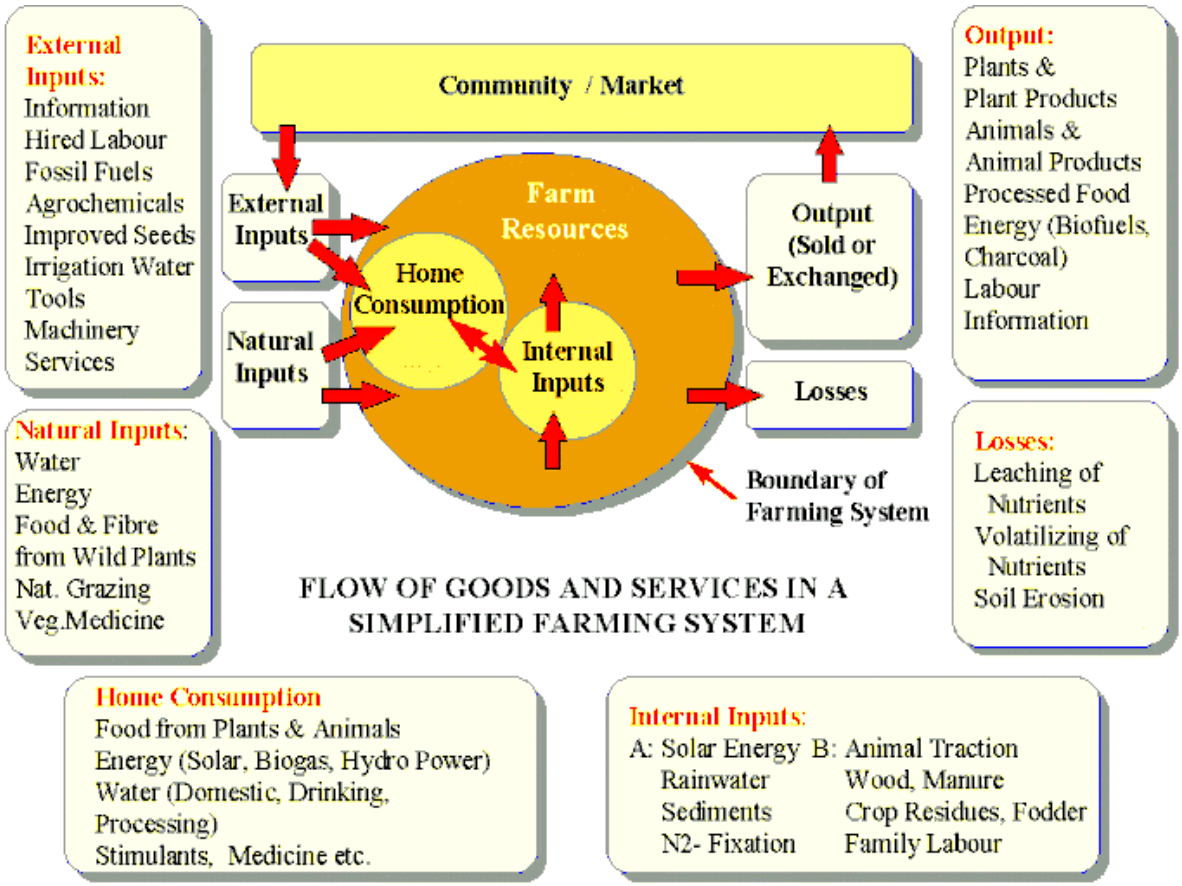

Fig 3: Flow of Goods and Services in a Simplified Farming System

Conclusions

We do not have answers to all the questions raised by ‘sustainable farming’, but in many instances good ideas exist to make it better. The question arises: Why do we continue to act unsustainably, while knowing that unsustainability will be a dead end road? Are there secret wishes or anxieties within our unconsciousness behind those actions? Are there reasons to be found in the ‘capitalistic’ system, where material wealth promises unlimited happiness? Why are so many politicians and other decision makers so fascinated by ‘growth’ phenomena, ignoring too often the urgency for changing the present course of technological and civilisational development? Is the short term of office for political leaders the reason for their often poor performance in preparing for the 21st century?

Whatever the reason might be, the answer must be radical: „A fairly fundamental cultural shift and an emphasis on sufficiency may indeed be a way of escaping the destructive dynamics depicted in ‘The Limits to Growth’" (Von Weizsaecker et al., 1997). What we need is a ‘change of the paradigms’, including

(1) new goals for teaching in schools, colleges and universities, where not only ‘technical’ skills should be learnt but also how to master life in a more sustainable way;

(2) a new way of thinking of decision makers in politics and economy to do their job in view of the needs of coming generations and

(3) visions and practical guidelines for farmers to find ways to feed the world with the least amount of resource input and with least destruction of the ecological systems.

The authors of ‘Beyond the Limits’ express their view in stating: "The transition to a sustainable society requires...an emphasis on sufficiency, equity, and quality of life rather than on quantity of output. It requires more than productivity and more than technology; it also requires maturity, compassion, and wisdom" (Meadows et al. 1992).

We need well-functioning institutions, well deliberated policies and far-sighted politicians. But we also need researchers who will accept their responsibility for the implementation of this new way of thinking by contributing new ideas and new products appropriate to the new goal.

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