

## **Sustainability in the Technological Development of the Hungarian Agriculture**

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### **Abstract**

The final outcome of agricultural production basically depends on applied technologies. In a simplified definition technology is the method of production, the chain of logically and rationally connected operations.

The technological development itself has no cease being a self propelling process. The logical development strategy for Hungarian agriculture „here and now” depends on several aspects. The countries in the world can be divided into two major groups; industrialised and developing ones. Hungary would be placed somewhere between the two. The previous „socialist” system has exhausted already, however the new, market-oriented system is not yet established.

The paper is dealing with the Hungarian problems and possibilities of agricultural technological development concerning sustainable production.

### **1. Development approach**

„Development” is a common word, but it has various meanings. In relation to agriculture „development” can be explained best as one among a range of words including „change”, „growth”, „progress”, „advance”, „modernisation” and „reconstruction”.

The most useful definition of development of agriculture is changes in the biological, chemical, technical, human and farm-economic sub-systems of agriculture and in their relations with the socio-economic system, that are of more than short duration and have more than short-term consequences, and the process that affect these changes or determine their consequences.

Thus some of the changes may prove favourable and some others unfavourable. Some of them may determine now, while others only years later. Some may be fostered or imposed from outside agriculture. Some of them may be natural, rather than the direct result of human decisions. Particular social groups in or outside agriculture may play particular roles in bringing about change. Different groups may be affected differently. The changes may be accelerated or slowed down, or halted.

The definition can be used in all countries, and does not depend on any ideas of „under-development” or poverty. The definition requires logically that those who approve some particular development should state criteria by which they judge. (Reaburn, 1984.)

It is clear that agricultural development, spurred in part by education, the adoption of new technologies, and institutional improvements, can help stimulate broad-based economic development.

Agricultural development can potentially provide a direct increase in rural welfare.

When agricultural development has not been associated with concurrent concern for employment, this development has stimulated less overall economic development than would be possible. Agricultural development has sometimes led to reduced food imports and growing food stocks even though people remain hungry. Mellor has called for an employment-oriented strategy which stresses research, education, rural infrastructure and, most important low-capital intensity industries. A rural sector with growing income can provide a large domestic market for locally produced non-agricultural goods and services.

The logical development strategy for a particular country depends on the available resources, stage of development, and institutional structure of the country. (Norton, Alwang, 1993)

The following guidelines are elements in an alternative approach to development. They form a perspective strategy aimed at building environmental considerations into development planning.

1/ A positive view of the environment needs to be developed, on the basis of present and future livelihood creation: job, incomes and cost-savings. This means a shift towards emphasising the advantages of better environmental practises, including incentives.

2/ There is a need to develop labour and time-saving technology for fuel wood, water, food preparation and post-harvest storage activities.

3/ Wherever possible farm grown inputs should be substituted for market purchases, which make additional calls on scarce finance. This will reduce the external dependence of agricultural producers.

4/ Non-farm sources of income need to be considered together with the measures needed to make farming systems more sustainable. In practice poor household will not employ more sustainable practises if they perceive them as at the cost of income-generation. In some cases efforts at income supplementation may prevent more sustainable practices from being adopted.

5/ Improved livelihood security is required, involving such essential features as land tenure rights and access to common property resources. If extended access to „commons” is leading to increased degradation, other means of bolstering the household's livelihood need to be given emphasis, to provide the essential income supplementation.

6/ Government policies should be directed towards plugging gaps in the food system of critical importance to poor people in low resources areas: for example, post-harvest technology and storage, agro forestry, decentralised marketing, improved transport, better biomass utilisation and alternative sources of income generation. Plugging the „agricultural technology” gap means sharing skills and knowledge in the implementation and adaptation of technology as well as developing appropriate technology.

7/ Poor people's calculations are based on what they know and what they can anticipate. Better environmental monitoring and forecasting are therefore necessary, and the resulting information and predictions should be much more widely disseminated.

The countries in the world can be divided into two major groups; industrialised and developing ones. In the development of agriculture in the industrialised countries, the forces favour specialisation. In most developing countries the respective conditions are the opposite of those in the industrialised countries. Hungary can be placed somewhere between the two, in my opinion.

(Table 1.)

*Table 1. Conditions for agricultural development: differences between industrialised and developing countries*

Criteria	Industrialised countries	Hungary	Developing countries
Climate-related production risk	lower	lower	higher
Potential negative impact of mechanisation on environment	lower	medium	higher
Population growth	slow	decreasing	rapid
Proportion of population employed in agricultural sector	decreasing	decreasing	constant
Transport and market structure	good	medium	poor
Degree of market involvement	higher	medium	lower

Purchasing power and  
availability of external  
inputs

higher medium lower

Specialisation  
and labour

productivity

higher higher lower

The Hungarian agriculture similarly to the ones in the other „former socialist” countries underwent/ goes basic changes in the early nineties. The earlier formed structural features have been blown up and the transformation has shaken the agriculture as a whole. The participants orientate and move more uncertainly among the new markets comparing with the previous system.

The large-scale state farms and co-operatives totally closed down or were basically transformed. During the transformation the private ownership and the small-scale farms had a priority.

## 2. Technology approach

The final outcome of agricultural production basically depends on the applied technology. Quite simply the technology is the method of production, the chain of logically and rationally connected operations of production.

In a given place and time the applied technologies express well:

- the level of agricultural innovation background
- the ambitions and possibilities of producers
- the different demand and claim of customers
- the agricultural policy of the given state/government.

Basically two approaches to farming development are possible: designing new farming systems or improving existing systems. Here I argue for emphasis on the latter, in such a way that activities of agricultural researchers complement and support the informal R+D efforts of the agricultural enterprises. New, integrated systems of farming are too complex and risky to be readily adopted by farmers. The Hungarian agricultural producers have better abilities and are more likely to test small changes or new components which fit into their existing production system. Through their informal R+D, they already have experience in observing the effects of small changes within highly complex and interactive agroecosystems involving multi-storey cropping, livestock, micro variations in land forms and soils, and highly variable climatic conditions.

A technological development approach is needed which combines the knowledge and skills of farmers to deal with their particular environments and the new ideas and scientific knowledge of researchers about developing agriculture.

The researchers have the tasks of discovering ecologically and economically sound methods practised by the farmers, recognising their attempts to adjust to changing conditions yet retain sustainability of their farming system and, in collaboration with farmers, devising methods to help them adjust.

„Technical innovations which are designed by development organisations at technology centres, for the most part without any knowledge of the prevailing institutional and organisational conditions, and are tested on target groups do not lead to any change in existing farming systems” (Becker, 1986.)

A simplified scheme of agricultural technical innovation flow is on the Fig. 1. The changing agricultural enterprises are in the focus of these activities, for it is primarily on this level that decisions are made to modify production methods. This means that farming R+D programmes must be highly pragmatic, i.e. related to the realities of the situation. The nature of these realities can be grasped only if technical and scientific questions are viewed in relation to the social, economic and political features of the production system as experienced by the agricultural producers.

New R+D programmes obviously need to be system-oriented and interdisciplinary if they are to address the problems of agricultural enterprises. The new challenges of the market economy raise a huge amount of questions

and problems. Among these tasks the development of production technologies is an important one, because the previously well developed technologies can be postponed, because the one who wants to stay in competition and goes by the claim of the market has to apply the most suitable technologies.

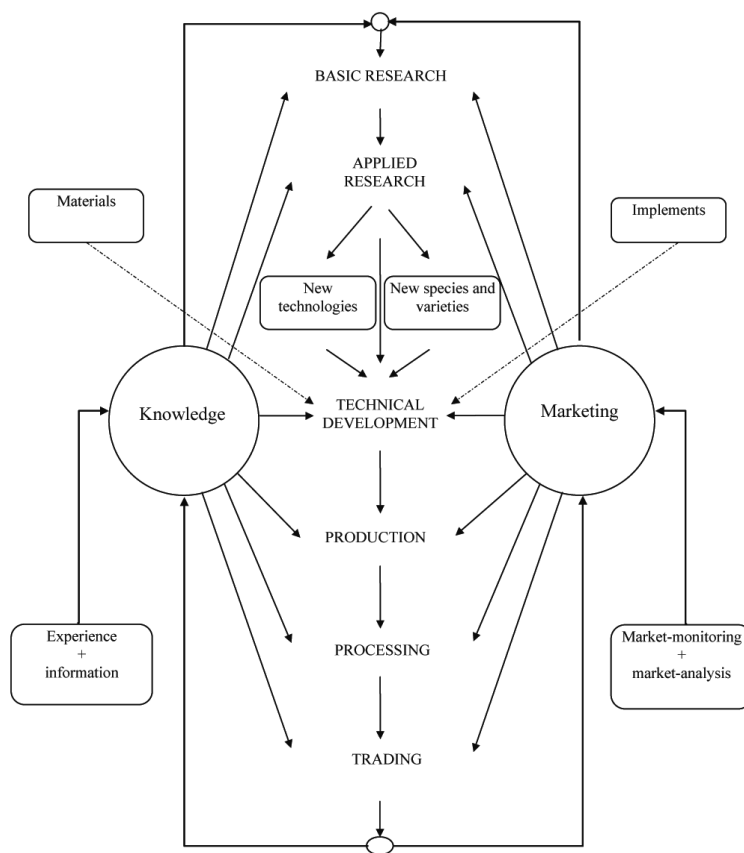


Figure 1. A simplified scheme of agricultural technical innovation flow

The technological development never has an end in itself. When the producers change the method of production they don't do it only to please the others. The rational development has always a reliable objective (or several ones at the same time).

The practical development can be aimed at:

- maximalization of yields (outputs)
- minimalization of inputs
- satisfying special quality requirements
- help the environmental and sanitary protection
- improve profitability or
- reach other particular objectives.

It is easy to see that we can't meet these several requirements, because each time conflicting aspects must be harmonised.

That's why concerning the technological development the rational combination of the different objectives, ambitions and possibilities have to be found. It can be also expressed in a concrete technology or in the different philosophies followed by the producers in different branches.

According to our experiences there are all kinds of ambitions in technological development, but three of them are so characteristic that they need the individual analysis.

They are as follows:

- maximalization of yields
- organic farming

– ecofarming.

The basis of these objectives is the idea that agriculture is an economic activity, which takes place in agricultural enterprises, and which produces high quality and save food products without damaging the physical environment in an irreversible way. Environmental requirements are considered to be integrated parts of the agricultural policy and they will be no longer an external condition (Bruijnen-Speelman, 1992.)

The mainstream approach to modernising agriculture has led to dependency on external inputs, e.g. of seed, fertiliser, pesticides, machinery, and fossil fuels. In recent years, concern with both resource limitations and the ecological repercussions of modern technology has led to a growing awareness of the need for environmental protection and ecologically sound practices in agriculture as well as other forms of research and management. Specifically in agricultural development, the need gradually being recognised to find ways of meeting production requirements without excessive strain on non-renewable natural resources.

3. Sustainability approach (Sustainability as a basic principle of development)

In connection with the development of agriculture the most characteristic feature has been „sustainable” in the last decade. A number of people think all over the world that „sustainable agriculture” is the only possible strategy of agricultural development in the future.

The spread of sustainable agriculture as a development conception is a universal phenomenon! The way how to change and make popular the general conception is different in the countries, it depends on the state of development of national economy. It is very important because this „sustainable agriculture” gets a rational sense when the general philosophical theories appear in the form of concrete aims and tasks in a given place and time.

That's why technological development is so important in the success of this conception.

From the general conception of „sustainable agriculture” (see some of them in appendix 1.) excel the remarkable areas in connection with the „sustainable technological development”. The important ones are as follows:

- soil conservation and rational soil utilisation,
- water conservation, questions of irrigation,
- use of artificial fertiliser and plant-protecting material its quantitative, qualitative and structural characteristics,
- methods of protection against pests, insects and diseases
- problems of productivity and the applied species, their resistance against stress,
- questions of energy production and its efficient use especially the renewable energy sources,
- use of farming systems with regard to their profitability.

Sustainable farming practices vary from farm to farm but commonly include:

1/ Crop rotations that mitigate weeds, disease, insect and other pest problems.

Provide alternative sources of soil nitrogen. Reduce soil erosion. Reduce risk of water contamination by agricultural chemicals.

2/ Pest control strategies that are not harmful to natural systems, farmers, their neighbours, or consumers. This includes integrated pest management techniques that reduce the need for pesticides by practices such as scouting, use of resistant cultivars, timing of planting, and biological pest controls.

3/ Increased mechanical/biological weed control, more soil and water conservation practices, and use of animal and green manure.

4/ Use of natural or synthetic inputs in a way that poses no significant hazard to men, animals, or the environment. (O’Connel, 1992.)

3.1. *The example of Iowa*

The Iowa Groundwater Protection Act defined sustainable agriculture as „the appropriate use of crop and livestock system and agricultural inputs supporting those activities which maintain economic and social variability while preserving the high productivity and quality of Iowa's land.”

We can find some messages in this relatively simplified definition which could be useful for the Hungarian practice, too.

The word „appropriate” in the definition recognises that sustainable agriculture is not a concrete set of practices. Instead, sustainable agriculture is site-specific. The site includes not just the physical location but also the relationship of the location to its surroundings, the farmer and the farm family, their resources, and their goals. The idea is that a sustainable mix of crops, livestock, and practices in one situation may not be sustainable in another situation.

„Crop and livestock systems” in the definition implies that sustainable agriculture includes both farming activities. Furthermore, sustainable agriculture uses „system” approaches which look at all aspects and how they interconnect, as contrasted with „reductionist” approaches which try to isolate single aspects of the production process. The system approach looks at the puzzle rather than at individual pieces.

The use of agricultural „inputs” is another distinguishing feature of the Iowa definition of sustainable agriculture. The agricultural inputs – chemicals, manure, fertiliser, labour, etc. – can be either external or internal to the farm. The question in sustainable agriculture is not how to eliminate inputs but rather how to choose the appropriate mix of resources from all those available. Economic and social viability are also essential components of any sustainable agriculture scenario. If a farm is not profitable it is not sustainable. Social viability refers to the health and viability of the rural communities in which farmers must live. Social viability also relates to agriculture's ability to produce a safe and adequate food supply at a reasonable cost.

Finally, the Iowa definition refers to preserving the high productivity and quality of the land. While the term „land” is used, this can be taken to mean natural resources as well, including the soil and water. A concern for preserving the quality shows that sustainable agriculture looks not just at the current generation but also at future generations. Although this definition says „Iowa”, any other state, country, or institutional unit could be substituted.

#### **4. Some characteristics of the basic options of practical development of technology**

A/ In case of maximalization of yields the main objective is to reach the maximum output on the production unit. The technological solutions and the combination of inputs are subordinated to that aim in the frame of the local conditions. The most important advantage is making the best use of potential productivity. The source of the problems at the same time is that the requirements of efficiency and profitability, the aspects of environmental and sanitary protection and some time the quality requirements are pushed into the background.

B/ The organic farming emphasises the environmental and sanitary protection and usually stress the farming totally free from fertilisers and chemicals.

The conception has several advantages but there are numerous problems too, first of all at profitability. These are e.g.

- the yields are lower at most agricultural branches comparing with the ones of traditional technologies and the extra selling price isn't able to compensate it,
- some of the organic products are less market oriented, their appearance is poorer comparing with the traditional ones,
- there is a narrow stratum of customers with solvent demand interested in organic products.

C/ The ecological and cost reduction programme started in the United States

became well known as LISA. It means Low Input / Sustainable Agriculture.

The essence of the conception that in contrast with the organic farming it doesn't refuse the chemicals totally but – not just for cost reduction – uses up as little as possible. The same goes for machinery and also for the „outside” resources. At the same time it makes a more efficient use of the on-farm possibilities.

In this sense the German concept of site-appropriate agriculture („Standortgerechter Landbau”) builds on a long tradition of location economics and farm management theory. Other countries in various part of the world, and similar concepts are being promoted, e.g. ecologically sound agriculture, organic farming, conservation agriculture, sustainable agriculture. All refers to forms of agricultural land use which depend primarily or almost exclusively on local resources to achieve lasting productivity, i.e. sustainable agriculture with low levels of external inputs. For the sake of brevity, this is often be referred to „ecofarming”.

In view of the limited access of most farmers to artificial external inputs, the limited value of these inputs under low-external-inputs agriculture (LEIA) conditions, the ecological and social threats of „green revolution” technology and the dangers of basing production on non-renewable energy sources, the strong emphasis on high-external-inputs agriculture (HEIA) must be questioned. However, it is also open to question whether it will be possible to raise world food production sufficiently without the use of such external inputs. Besides, natural as opposed to artificial inputs can also, have detrimental environmental effects.

Low-external-input sustainable agriculture (LEISA) is an option which is feasible for a large number of farmers and which can complement other forms of agricultural production. As most farmers are not in a position to use artificial inputs or can use them only in small quantities, it is necessary to concentrate on technologies that make efficient use of local resources. Also, those farmers who now practise HEIA could reduce contamination and costs and increase the efficiency of the external inputs by applying some LEISA techniques. It is important that the agroecological knowledge of both scientists and farmers be applied, so that internal and external inputs can be combined in such a way that the natural resources are conserved and enhanced, productivity and security are increased and negative environmental effects are avoided.

LEISA refers to those forms of agriculture that:

- *seek* to optimise the use of locally available resources by combining the different components of the farm system, i.e. plants, animals, soil, water, climate, and people, so that they complement each other and have the greatest possible synergetic effects;

- *seek* ways of using external inputs only to the extent that they are needed to provide elements that are deficient in the ecosystem and to enhance available biological, physical and human resources. In using external inputs, attention is given mainly to maximum recycling and minimum detrimental impact on the environment.

LEISA does not aim at maximum production of short duration but rather at a stable and adequate production level over the long term. LEISA seeks to maintain and, where possible, enhance the natural resources and make maximum use of natural processes. Where part of the production is marketed, opportunities are sought to regain the nutrients brought to the market.

#### *4.1. Strategies for transition to LEISA*

Transition is the process of conversion from an unbalanced conventional or traditional farm system to an economically, ecologically and socially balanced (LEISA) one. As regaining an ecological balance may take many years, particularly when this involves growing trees and breeding animals, a transition process can be lengthy. As the conditions for farming will also be changing during transition, the farmers' capacity to adapt to these changes will be crucial for successful transition. However, it must be emphasised that transition is more

than just adaptation to change, it is a conscious process to make the farm system more balanced and sustainable.

Transition involves investments in labour, land and/or money and taking risk. To gain an acceptable level of yield increase quickly, to minimise risks and to spread investments, the farm family must find an acceptable transition strategy involving specific combinations of genetic resources, techniques and inputs in a deliberately chosen sequence. The particular technologies involved and the sequence in which they are combined will depend greatly on the biophysical and socio-economic characteristics of the farm, its historical development and present situation, and the needs and preferences of the farm household. Therefore, such strategies will be farm-specific.

The process of building and maintaining LEISA systems requires awareness of and knowledge about feasible technologies, skill in applying them and a constant watch for signs of degradation and destabilisation of the farm system. As it will not be completely certain what implications the changes will have for the farm household, the strategy for transition should be “undogmatic”, responsive to unexpected results and open-ended. Farmers embarking upon conversion to LEISA need to be highly motivated self-reliant and imaginative. Sustainable agriculture demands high internal inputs of good farm management.

Under LEIA conditions, where farmers may be particularly wary of the initial investments required and the risks of a temporary decrease in production, it is important that suitable „entry points” to a process of transition have to be found. These are starter techniques, which give good returns in the first season, involve relatively few risks and have positive effects on the ecosystem. Integration of these techniques can then lead to other beneficial changes in the farm system. Criteria for choosing technologies for human-centred agricultural improvement:

*Do the poorest farmers recognise the technology as being successful?*

- Does it meet a real need?
- Is it financially advantageous?
- Does it bring recognisable success quickly?
- Does it fit local farming patterns?

*Does the technology deal with those factors that most limit production?*

*Will the technology benefit the poor?*

- Does it utilise the resources the poor people already have?
- Is it relatively free of risk?
- Is it culturally acceptable to the poor?
- Is it labour-intensive rather than capital-intensive?
- Is it simple to understand?

*Is the technology aimed at adequate markets?*

- Are market prices both adequate and reliable?
- Is the market available to small farmers?
- Does the market have sufficient depth?

*Is the technology safe for the area's ecology?*

*Can the technology be communicated efficiently?*

- Does it require a minimum of on-site supervision?
- Is it simple to teach?

*Is the principle behind the technology widely applicable?*

(Source: Bunch, 1985.)

Legislation, marketing improvement and appropriate pricing policies can give important support to farmers seeking a strategy for transition. Many marginal farmers and enterprises may not be in a position to develop sustainable farm systems unless they have access to additional income, e.g. a kind of starter credit in a revolving fund which gives them the financial space to work on their farm instead of working as a farm labourer for others or going elsewhere to look for wage labour. Achieving sustainability is more easily advocated than put into



practice and, in the case of many marginal producers, it may not be possible to achieve unless supplementary sources of local, nonfarming income can be found.

## **5. Conclusions**

- The profitability of agriculture both on macro- and micro-level depends on the production technologies at several points. That is why technology development means an evergreen task.
- Concerning the technological development the uniform solutions must be avoided, as it means a dynamic task which must not be treated in isolation of place and time.
- All of the listed 3 options can be viable to reach the certain objectives at given conditions.
- Establishing any of the three options the basic principle can be the criteria-system of sustainability.
- The Hungarian agriculture - in its present situation - has directed its attention more seriously to the rational adaptation of LISA/LEISA philosophy.
- In the course of this it is suitable to keep to the direction of „precision farming”.

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## **Appendix 1**

### ***Some definitions of „sustainable agriculture”:***

– *FAO (Food and Agriculture Organisation of UNO):*

„Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sector) conserves land, water, plant and

animal genetic resources, is environmentally non degrading, technically appropriate, economically viable and socially acceptable".

– *WCED (World Committee of Environment and Development)*

„Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.“

– *American Society of Agronomy*

„A management system that uses inputs, both those available as natural resources on the farm and those purchased externally, in the most efficient manner possible to obtain productivity and profitability from a farming operation while minimising adverse effects on the environment.

A sustainable agriculture is one that, over the long term, (1)enhances environmental quality and the resource base of which agriculture depends, (2) provides for basic human food and fiber needs, (3) is economically viable , and (4) enhances the quality of life for farmers and society as a whole.“

– *The Brundtland Report („Our common Future“)*

„Sustainable systems are those that, meet current food requirements without compromising the possibilities for future generations to satisfy their food requirements.“

– *CGIAR/TAC (Consulting Group of International Agricultural Research / Technical Assistance Committee)*

„Sustainable agriculture involves the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources.“

– *U.S. Congress*

„Integrated system of plant and animal production practices having a site specific application that will, over the long term, satisfy human food needs, enhance environmental quality and the natural resource base upon which the agricultural economy, depends; make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole.“