10 Sustainable Agriculture

DFID Department for International Development

The purpose of these *Key Sheets* is to provide decision-makers with an easy and up-to-date point of reference on issues relating to the provision of support for sustainable livelihoods.

The sheets are designed for those who are managing change and who are concerned to make well-informed implementation decisions. They aim to distil theoretical debate and field experience so that it becomes easily accessible and useful across a range of situations. Their purpose is to assist in the process of decision-making rather than to provide definitive answers.

The sheets address three broad sets of issues:

- Service Delivery
- Resource Management
- Policy Planning and Implementation

A list of contact details for organisations is provided for each sub-series.

Ministerie van Buitenlandse Zaken
Ontwikkelingssamenwerking

Overview of the debate

The term 'sustainable agriculture' (SA) is associated with a wide range of interpretations and visions. It is used to describe a broad set of principles for agricultural development as well as to distinguish specific technological innovations. This *key sheet* reviews the origins of the term, the evolution of its application, some of the types of technology associated with sustainable agriculture, and challenges related to operationalising sustainability.

Key issues in decision making

The origins of the concept Much of the current interest in sustainable agriculture can be traced to environmental concerns that began to appear in the 1950s and 60s. Subsequent critiques of the social and economic impact of modern agriculture and the 'limits to growth' debate of the 1970s contributed to a new conceptualisation of agricultural development.

One interpretation of SA focuses on types of technology (especially strategies that reduce reliance on non-renewable or environmentally harmful inputs) carried out in particular settings. Much effort is devoted to developing and promoting these technologies.

A second interpretation focuses more on the concept of agricultural sustainability and goes beyond particular farming systems. Contributions include an acceptance of the fact that agricultural strategies should be based on more than simple productivity criteria, that externalities are of great importance, and that intra- and inter-generational equity are key parameters in assessing agricultural change.

New foci in development thinking provide a broader context for examining sustainable agriculture. Sustainable livelihoods can be used to examine outcomes at the local level, and concerns with globalisation draw attention to linkages between local and global processes beyond agriculture.

Dimensions of sustainability The parameters of sustainable agriculture have grown from an original focus on environmental aspects to include first economic and then broader social and political dimensions.

- *Ecological* The core concerns of SA are to reduce negative environmental and health externalities, to enhance and utilise local ecosystem resources, and preserve biodiversity. More recent concerns include broader recognition for positive environmental externalities from agriculture (such as carbon sequestration and flood protection).
- *Economic* Economic perspectives on SA attempt to assign value to ecological parameters and include a longer time frame in economic analysis. They also highlight subsidies that promote the depletion of resources or unfair competition with other production systems.
- *Socio-political* There are concerns about the equity of technological change. At the local level, SA is often associated with farmer participation, group action and the promotion of local institutions, culture and farming communities. Sustainability also includes attention to institutional and financial viability.

Balancing these various dimensions is one of the greatest challenges to the concept of sustainable agriculture. One prominent dilemma arises from the tendency of ecological system analysis to favour aspirations for local economic self-sufficiency, whilst economic analyses often point to gains from trade and specialisation. A second challenge involves ensuring that sustainable agriculture practices offer farmers short-term economic payoffs, whilst demonstrating the role of explicit or hidden subsidies for some current technology.

Types of technology Sustainable agriculture is associated with a wide variety of technology. Although these are applied in specific instances, most represent attempts to provide widely relevant strategies.

Several interpretations of sustainable agriculture feature the reduction of external inputs, such as low external input sustainable agriculture (LEISA). This seeks to optimise the use of locally available resources and includes attention to the enhancement of natural and socio-cultural resources. Other interpretations place even greater restrictions on the type of external input that may be used. One example is organic farming, which prohibits the use of any synthetic fertiliser or pesticide and focuses on nutrient recycling.

On the other hand, several technologies address problems of environmental degradation while remaining open about the degree of reliance on external inputs.

- *Integrated pest management* (IPM) utilises ecosystem resilience and biodiversity (taking advantage of opportunities for biological control). When pesticides are used, it substitutes threshold-based decision-making for calendar applications.

Expertise

- Centre for Information on Low External Input and Sustainable Agriculture (ILEIA), Leusden, Netherlands
- FAO, Plant Protection Service, Global Integrated Pest Management Facility, Rome
- International Federation of Organic Agriculture Movements (IFOAM), Tholey-Theley, Germany
- International Institute for Environment and Development (IIED), London
- International Institute of Rural Reconstruction (IIRR), Silang, Philippines
- International Water Management Institute (IWMI), Bangkok
- Rodale Institute, Kutztown, PA, USA
- University of Essex, Centre for Environment and Society, Colchester, UK
- Wageningen University and Research Centre, International Agricultural Centre, Netherlands

- *Integrated nutrient management* (INM) is concerned with bringing additional plant nutrients (including those from inorganic sources) to farm systems, reducing nutrient loss (through erosion control, conservation of crop residues, etc.), and increasing nutrient recycling.
- *Conservation tillage* is aimed at preventing soil erosion and enhancing natural processes for nutrient recycling and weed control; many (but not all) of its applications involve herbicide use.

Operationalising sustainability In order to assess these specific types of technology or evaluate the broader dynamics of agricultural change, some agreement is needed on how to measure sustainability.

- *Scale and hierarchy* One of the greatest challenges is to select appropriate scales of analysis. Agricultural sustainability can be measured at different levels, including the individual plot, farm, farming system, region, or nation. In general, the higher the level, the more difficult is the measurement. Lack of sustainability at one level does not necessarily indicate a problem at a higher level.
- *Stability* One of the hallmarks of a sustainable agricultural system is its capacity to withstand shocks and stresses. However, there is little agreement about how to assess this capacity. For instance, stability on its own, if associated with low productivity, is surely not acceptable. Agreement is also required on acceptable time frames, types of shocks that should be considered, and critical threshold levels.
- *Aggregate measures* There have been attempts to construct aggregate measures for sustainability. One suggestion (at the farming system level) is to use total factor productivity (the total value of all output produced by a system during one cycle, divided by the total value of all inputs used by the system. In order to accommodate non-market inputs and externalities, all factors can be valued at social prices. But there are serious problems in specifying these parameters and employing them in a useful way.
- *Indicators* There has also been considerable effort at developing multiple indicators for sustainability. One approach is to assess the flow of services derived from assets (or 'capitals' — physical, financial, natural, human and social) identified in the sustainable livelihoods approach. Such multiple measures allow the possibility of capturing more dimensions of sustainability, but there are problems in assessing relative weights and making overall judgements.
- *Discount rate* The discount rate aims to make the costs and benefits of future activities comparable with current ones. Discount rates based on private interest rates may reflect a 'dictatorship of the present' and are often too high to account for the public interest in long-term resource conservation. Although the use of (lower) social discount rates is often advised for assessing sustainability, the justification for particular choices needs further research.

Conclusions The concept of SA has been useful both for encouraging broader thinking about agriculture and its role, and for developing particular technologies. But the interpretations of SA seem to be growing rather than converging. If it is to be a concept that is useful for making development investment decisions, several actions are required.

First, the location-specific examples require closer evaluation to discard the impractical and upscale the feasible. In addition, more attention is required to link micro- and macro-level evaluation; the issue of scale is key in an age of globalisation. Finally, decision-makers employing the term need to present a sufficiently clear operational definition that allows them to make choices and assess trade-offs in agricultural development. Without this, sustainable agriculture will become merely a vague synonym for desirable change.

Key literature

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