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Inst. of Advanced
Studies, UN University

**Integrated Bio-Systems in Zero Emissions
Applications**

Proceedings of the Internet Conference on Integrated
Bio-Systems

Editors: Eng-Leong Foo & Tarcisio Della Senta. 1998
<http://www.ias.unu.edu/proceedings/icibs>



Participatory Learning for Integrated Farming

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*Original paper from the proceedings of the Workshop on Integrated farming in Human Development
(March 25-29, 1996. Tune Landboskole, Denmark) Eds: Frands Dolberg and Poul Henning Petersen..
<http://ifs.plants.ox.ac.uk/tune/tune96/contents.html>.*

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Summary

Increasing human population will require substantial increases in food production, which is well understood. However, it is less appreciated that to deliver such increases is not only a matter of availability of physical re-sources as inputs in the process of production, but - as important - of conducive schools of thought in science and approaches to learning. The paper is based on the assumption that agricultural development will have to be sustainable (in the terms defined in the paper) and provides recent evidence of impact achieved. Experience demonstrates participation by people is a critical condition for success in sustainable agricultural development and interest in application of participatory approaches is growing. Assuming the meaning of sustainability encompasses activities spread beyond a project in space and time, participation requires collective analyses by inter-disciplinary and intersectoral teams, and even a researcher working alone must cooperate closely with local people. The paper goes on to discuss conditions for scaling-up of sustainable agriculture. Principal among these are farmers' capacity to innovate and it is the process, which sustains this capacity which is important and much less specific technologies. A new professional able to select methodologies according to needs and work in multidisciplinary teams and not afraid of interaction with non-scientific people will facilitate spread of sustainable agriculture and so will an institutionalisation of these approaches.

Key words: Learning, agriculture, sustainable, participatory, professionalism.

Challenges for agricultural development

Agricultural development now faces some unprecedented challenges. By the year 2020, the world will have 2.5 billion more people than today. Even though enough food is produced in aggregate to feed everyone, and that world prices have been falling in recent years, some 700-800 million people still do not have access to sufficient food. This includes 180 million children underweight and suffering from malnutrition.

It is now widely accepted that over the next quarter to half century food production will have to increase substantially.

But the views on how to proceed vary hugely. Some are optimistic, even complacent; others are darkly pessimistic. Some indicate that not much needs to change; others argue for fundamental reforms to agricultural and food systems. Some indicate that a significant growth in food production will only occur if new lands are taken under the plough; others suggest that there are feasible social and technical solutions for increasing yields on existing farmland.

There are five distinct schools of thought over these future options in agricultural development.

Schools of thought

There are "*optimists*", who say supply will always meet increasing demand, and so recent growth in aggregate food production will continue alongside reductions in population growth (Rosegrant and Agcaoili, 1994; Mitchell and Ingco, 1993; FAO, 1993). As food prices are falling (down 50% in the past decade for most commodities), this indicates that there is no current crunch over demand. Food production is expected to grow for two reasons: i) the fruits of biotechnology research will soon ripen, so boosting plant and animal productivity; ii) the area under cultivation will expand, probably by some 20-40% by 2020 (by an extra 79 million ha in Sub-Saharan Africa alone). It is also expected that developing countries will substantially increase food imports from industrialised countries (perhaps by as much as 5 fold by 2050).

There are "*environmental pessimists*", who suggest that ecological limits to growth are being approached); are soon to be passed; or have already been reached (Harris, 1995; Brown, 1994; CGIAR, 1995; Kendall and Pimentel, 1994; Brown and Kane, 1994; Ehrlich, 1968). It is said that populations are too great; yield growth has slowed, and will slow more, stop or even fall; no new technological breakthroughs are likely; and that environments have been too thoroughly degraded for recovery. Solving these problems means putting population control as the first priority

The "*industrialised world to the rescue*" group believes that Third World countries will never be able to feed themselves, for all sorts of ecological, institutional and infrastructural reasons, and so the looming food gap will have to be filled by modernized agriculture in the North (Avery, 1995; Wirth, 1995; DowElanco, 1994; Carruthers, 1993; Knutson et al, 1990). Increasing production in large, mechanised operations will allow smaller and more 'marginal' farmers to go out of business, so taking the pressure off natural resources, which can then be conserved in protected areas and wildernesses. These large producers will then be able to trade their food with those who need it, or have it distributed by famine relief or food aid. It is also vigorously argued that any adverse health and environmental consequences of modern agricultural systems are minor in comparison with those wrought by the expansion of agriculture into new lands.

One group, what we might call the '*new modernists*', argues that biological yield increases are possible on existing lands, and that this food growth can only come from high-external input farming (Borlaug, 1992, 1994a, b; Sasakawa Global 2000, 1993, 1994; World Bank, 1993; Paarlberg and Breth, 1994; Winrock International, 1994; Crosson and Anderson, 1995). The target is both the existing Green Revolution lands, and the 'high-potential' lands that have been missed by the past 30 years of agricultural development. This group argues that farmers simply use too few fertilizers and pesticides, which are said to be the only way to improve yields and so keep the pressure off natural habitats. This repeat of the green revolution model is called 'science-based' agriculture, the objective being to increase farmers' use of fertilizers and pesticides. It is also argued that high-input agriculture is more environmentally sustainable than low-input, as low-input agriculture can only ever be low output.

The case is also being made for the benefits of '*sustainable intensification*', on the grounds

that substantial growth is possible in currently unimproved or degraded areas whilst at the same time protecting or even regenerating natural resources (Pretty, 1995a, b; Hazell, 1995; McCalla, 1994, 1995; Scoones and Thompson, 1994; NAF, 1994; Hewitt and Smith, 1995; Röling and Wagemakers, 1996).

It is argued that empirical evidence now indicates that regenerative and low-input (but not necessarily zero-input) agriculture can be highly productive, provided farmers participate fully in all stages of technology development and extension. This evidence also suggests that agricultural and pastoral lands productivity is as much a function of human capacity and ingenuity as it is of biological and physical processes. Sustainable agriculture seeks the integrated use of a wide range of pest, nutrient, soil and water management technologies.

What is and what is not sustainable agriculture

A great deal of effort has gone into trying to define sustainability in absolute terms. Since the Brundtland Commission's definition of sustainable development in 1987, there have been at least 100 more definitions constructed, each emphasising different values, priorities and goals. But precise and absolute definitions of sustainability, and therefore of sustainable agriculture, are impossible. Sustainability itself is a complex and contested concept. To some it implies persistence and the capacity of something to continue for a long time. To others, it implies not damaging or degrading natural resources. In any discussion of sustainability, it is important to clarify what is being sustained, for how long, for whose benefit and at whose cost, over what area and measured by what criteria. Answering these questions is difficult, as it means assessing and trading off values and beliefs.

It is critical, therefore, that sustainable agriculture does not prescribe a concretely defined set of technologies, practices or policies. This would only serve to restrict the future options of farmers. As conditions change and as knowledge changes, so must farmers and communities be encouraged and allowed to change and adapt too. Sustainable agriculture is, therefore, not a simple model or package to be imposed. It is more a process for learning (Pretty, 1995b; Röling, 1994).

The basic challenge for sustainable agriculture is to make better use of available physical and human resources. This can be done by minimizing the use of external inputs, by regenerating internal resources more effectively, or by combinations of both. This ensures the efficient and effective use of what is available, and ensures that any changes will persist as dependencies on external systems are kept to a reasonable minimum.

A sustainable agriculture, therefore, is any system of food or fibre production that systematically pursues the following farming objectives:

- A thorough incorporation of natural processes such as nutrient cycling, nitrogen fixation, and pest-predator relationships into agricultural production processes, so ensuring profitable and efficient food production;
- A minimisation in the use of those external and non-renewable inputs with the greatest potential to damage the environment or harm the health of farmers and consumers, and a more targeted use of the remaining inputs used with a view to minimising costs;
- The full participation of farmers and rural people in all processes of problem analysis, and technology development, adaptation and extension;
- A more equitable access to productive resources and opportunities, and progress towards more socially-just forms of agriculture;
- A greater productive use of local knowledge and practices, including innovative approaches not yet fully understood by scientists or widely adopted by farmers;
- An increase in self-reliance amongst farmers and rural people;
- An improvement in the match between cropping patterns and the productive potential

and environmental constraints of climate and land-scape to ensure long-term sustainability of current production levels.

Sustainable agriculture seeks the integrated use of a wide range of pest, nutrient, soil and water management technologies. It aims for an increased diversity of enterprises within farms combined with increased linkages and flows between them. By-products or wastes from one component or enterprise become inputs to another. As natural processes increasingly substitute for external inputs, so the impact on the environment is reduced.

New evidence on impacts

There is now emerging evidence that regenerative and resource-conserving technologies and practices can bring both environmental and economic benefits for farmers, communities and nations. The best evidence comes from countries of Africa, Asia and Latin America, where the concern is to increase food production in the areas where farming has been largely un-touched by the modern packages of externally-supplied technologies. In these lands, farming communities adopting regenerative technologies have substantially improved agricultural yields, often only using few or no external inputs (Bunch, 1990, 1993; GTZ, 1992; UNDP, 1992; Krishna, 1994; Shah, 1994; SWCB, 1994; Balbarino and Alcober, 1994; Pretty, 1995a)

A recent study of 86 projects in 14 countries of East and Southern Africa discovered that improvements are now occurring for at least 230,000 farming families (Hinchcliffe et al, 1996). Over 6 million hectares are being farmed with sustainable agriculture, and on average crop yields have more than doubled. All the projects are using resource-conserving technologies and are working in a participatory fashion with local people.

But these are not the only sites for successful sustainable agriculture. In the high-input and generally irrigated lands, farmers adopting regenerative technologies have maintained yields whilst substantially reducing their use of inputs (Bagadion and Korten, 1991; Kenmore, 1991; van der Werf and de Jager, 1992; UNDP, 1992; Kamp et al, 1993; Pretty, 1995a). And in the industrialised countries, farmers have been able to maintain profitability, even though input use has been cut dramatically, such as in the USA (NRC, 1989; NAF, 1994; Hewitt and Smith, 1995); and in Europe (Pretty and Howes, 1993; Reus et al, 1994; Somers, 1996).

But this empirical evidence is still contested. In the USA, for example, some 82% of conventional US farmers believe that low input agriculture will always be low output (Hewitt and Smith, 1995). Two influential politicians have recently emphasised these beliefs. In 1991, the Secretary of Agriculture, Earl Butz, said

"we can go back to organic agriculture in this country if we must - we once farmers that way 75 years ago. However, before we move in that direction, someone must decide which 50 million of our people will starve. We simply cannot feed, even at subsistence levels, our 250 million Americans without a large production input of chemicals, antibiotics and growth hormones".

In 1996, Under-Secretary for Agriculture, Eugene Moos, said:

"The prospective increase in world population will double food aid needs in the next decade... and it will be necessary for agricultural producing nations to use biotechnology and hormones to meet growing demand."

Yet a selection of recent evidence (Box 1) shows quite the opposite. In the USA, some 40,000 farmers in 32 states are using sustainable agriculture technologies and have cut their use of external inputs substantially. This includes 2800 sustainable agriculture farmers in the North Western States, who grow twice as many crops compared with conventional farmers, use 60-70% less fertilizer, pesticide and energy, and their yields are roughly comparable; they also spend more money on local goods and services - each farm contributed more than £13,500 to

its local economy.

Box 1. Successful sustainable and integrated agriculture in selected countries

Bangladesh: 5000 farming families

Fish in rice fields combined with integrated pest management technologies and participatory action learning approach; rice yields up 12% and pesticide use cut to zero.

Brazil: 38,000 farming families

Community-based microwatershed programme, with farmers growing more than 60 species of green manures and cover crops; yields more than doubling and farmers needing less labour for weeding and ploughing.

Germany: 55,400 farmers in Baden Württemberg

Following the establishment of the MEKA scheme of incentives, farmers have cut pesticide and fertilizer use; extensified grassland systems; increased the use of cover crops and legumes; protected rare breeds; and increased undersowing.

Guatemala and Honduras: 8000 farming families

Regenerative agriculture based on soil conservation, green manures, farmer experimentation and farmer extensionists; yield increases of 2-3 fold, continued beyond the projects and spreading independently, with sustainable agriculture now the motor for local economic growth.

Indonesia: 400,000 farmers

Integrated pest management for rice programme with farmer field schools as the mechanism to enhance farmers' capacity to learn about their farming environment and innovate; rice yields have stabilised or slightly increased even though all farmers have substantially cut pesticide use (25% no longer use pesticides at all).

East and Southern Africa: 250,000 farming families (in Angola, Botswana, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Uganda, Zambia, Zimbabwe):

80 community-based projects with 6 million hectares farmed with sustainable agriculture technologies; with participatory learning methods being used to develop farmers' capacity to experiment and develop their own solutions, resulting in an average doubling of crop yields using only regenerative technologies.

USA: 40,000 farmers

Farmers using sustainable agriculture technologies grow twice as many crops compared with conventional farmers, use 60-70% less fertilizer, pesticide and energy, and their yields are roughly comparable; they also spend more money on local goods and services.

Recent growth in interest in participation

There is a long history of participation in agricultural development, and a wide range of development agencies, both national and international, have attempted to involve people in some aspect of planning and implementation. Two overlapping schools of thought and practice have evolved. One views participation as a means to increase efficiency, the central notion being that if people are involved, then they are more likely to agree with and support the new development or service. The other sees participation as a fundamental right, in which the main aim is to initiate mobilization for collective action, empowerment and institution building.

In recent years, there have been an increasing number of comparative studies of development projects showing that ‘participation’ is one of the critical components of success. It has been associated with increased mobilization of stakeholder ownership of policies and projects; greater efficiency, understanding and social cohesion; more cost-effective services; greater transparency and accountability; increased empowering of the poor and disadvantaged; and strengthened capacity of people to learn and act (Cernea, 1991; Pretty and Sandbrook, 1991; Uphoff, 1992; Narayan, 1993, 1995; World Bank, 1994; Pretty, 1995a, b; Thompson, 1995).

As a result, the terms ‘people's participation’ and ‘popular participation’ have become part of the normal language of many development agencies, including NGOs, government departments and banks (Adnan et al, 1992). It is such a fashion that almost everyone says that participation is part of their work. This has created many paradoxes. The term ‘participation’ has been used to justify the extension of control of the state as well as to build local capacity and self-reliance; it has been used to justify external decisions as well as to devolve power and decision-making away from external agencies; it has been used for data collection as well as for interactive analysis.

In conventional rural development, participation has commonly centred on encouraging local people to sell their labour in return for food, cash or materials. Yet these material incentives distort perceptions, create dependencies, and give the misleading impression that local people are supportive of externally-driven initiatives. This paternalism undermines sustainability goals and produces impacts which rarely persist once the project ceases (Bunch, 1983; Reij, 1988; Pretty and Shah, 1994; Kerr, 1994). Despite this, development programmes continue to justify subsidies and incentives, on the grounds that they are faster, that they can win over more people, or they provide a mechanism for disbursing food to poor people. When little effort is made to build local skills, interests and capacity, then local people have no stake in maintaining structures or practices once the flow of incentives stops.

The many ways that development organisations interpret and use the term participation can be resolved into seven clear types. These range from manipulative and passive participation, where people are told what is to happen and act out predetermined roles, to self-mobilization, where people take initiatives largely independent of external institutions (Table 1).

Table 1. A typology of participation: how people participate in development programmes and projects

	Typology	Characteristics of Each Type
1	Manipulative Participation	Participation is simply a pretence, with ‘people's’ representatives on official boards but who are unelected and have no power.
2	Passive Participation	People participate by being told what has been decided or has already happened. It involves unilateral announcements by an administration or project management without any listening to people's responses. The information being shared belongs only to external professionals.
3	Participation by Consultation	People participate by being consulted or by answering questions. External agents define problems and information gathering processes, and so control analysis. Such a consultative process does not concede any share in decision-making, and professionals are under no obligation to take on board people's views.
4	Participation for Material Incentives	People participate by contributing resources, for example labour, in return for food, cash or other material incentives. Farmers may provide the fields and labour, but are involved in neither experimentation nor the process of learning. It is very common to see this called participation, yet people have no stake in prolonging technologies or practices when the incentives end.

5	Functional Participation	Participation seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project. Such involvement may be interactive and involve shared decision making, but tends to arise only after major decisions have already been made by external agents. At worst, local people may still only be coopted to serve external goals.
6	Interactive Participation	People participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives and make use of systemic and structured learning processes. As groups take control over local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices.
7	Self-Mobilization	People participate by taking initiatives independently of external institutions to change systems. They develop contacts with external institutions for resources and technical advice they need, but retain control over how resources are used. Self-mobilization can spread if governments and NGOs provide an enabling framework of support. Such self-initiated mobilization may or may not challenge existing distributions of wealth and power.

Source: Pretty, 1995a

This typology suggests that the term 'participation' should not be accepted without appropriate clarification. The problem with participation as used in types one to four is that any achievements are likely to have no positive lasting effect on people's lives (Rahnema, 1992). The term participation can be used, knowing it will not lead to action. Indeed, some suggest that the manipulation that is often central to types one to four mean they should be seen as types of non-participation (Hart, 1992).

The World Bank's internal 'Learning Group on Participatory Development', in seeking to clarify the benefits and costs of participation, distinguished between different types of participation: "many Bank activities which are termed 'participatory' do not conform to [our] definition, because they provide stakeholders with little or no influence, such as when [they] are involved simply as passive recipients, informants or labourers in a development effort" (World Bank, 1994).

Another study of 121 rural water supply projects in 49 countries of Africa, Asia and Latin America found that participation was the most significant factor contributing to project effectiveness and maintenance of water systems (Narayan, 1993). Most of the projects referred to community participation or made it a specific project component, but only 21% scored high on interactive participation. Clearly, intentions did not translate into practice. It was when people were involved in decision-making during all stages of the project, from design to maintenance, that the best results occurred. If they were just involved in information sharing and consultations, then results were much poorer. According to the analysis, it was clear that moving down the typology moved a project from a medium to highly effective category.

Great care must, therefore, be taken over both using and interpreting the term participation. It should always be qualified by reference to the type of participation, as most types will threaten rather than support the goals of sustainable agriculture. What will be important is for institutions and individuals to define better ways of shifting from the more common passive, consultative and incentive-driven participation towards the interactive end of the spectrum.

Alternative systems of participatory learning and action

Recent years have seen a rapid expansion in new participatory methods and approaches to learning in the context of agricultural development (see PLA Notes (formerly RRA Notes), 1988-present; PALM Series, 1991-present; Pretty et al, 1995; IDS/IIED, 1994; Chambers,

1994a, b, c; Mascarenhas et al, 1991). Many have been drawn from a wide range of non-agricultural contexts, and were adapted to new needs. Others are innovations arising out of situations where practitioners have applied the methods in a new setting, the context and people themselves giving rise to the novelty.

There are now more than 30 different terms for these systems of learning and action, some more widely used than others. Participatory Rural Appraisal (PRA), for example is now practised in at least 130 countries. This diversity and complexity is a strength, as it is a sign of both innovation and ownership.

There are six common principles of these systems of learning:

- A defined methodology and systemic learning process - the focus is on cumulative learning by all the participants and, given the nature of these approaches as systems of inquiry and interaction, their use has to be participative. The emphasis on visualisations democratises and deepens analysis.
- Multiple perspectives - a central objective is to seek diversity, rather than characterise complexity in terms of average values. The assumption is that different individuals and groups make different evaluations of situations, which lead to different actions. All views of activity or purpose are heavy with interpretation, bias and prejudice, and this implies that there are multiple possible descriptions of any real-world activity.
- Group learning process - all involve the recognition that the complexity of the world will only be revealed through group inquiry and interaction. This implies three possible mixes of investigators, namely those from different disciplines, from different sectors, and from outsiders (professionals) and insiders (local people).
- Context specific - the approaches are flexible enough to be adapted to suit each new set of conditions and actors, and so there are multiple variants.
- Facilitating experts and stakeholders - the methodology is concerned with the transformation of existing activities to try to bring about changes which people in the situation regard as improvements. The role of the 'expert' is best thought of as helping people in their situation carry out their own study and so achieve something.
- Leading to sustained action - the learning process leads to debate about change, and debate changes the perceptions of the actors and their readiness to contemplate action. Action is agreed, and implementable changes will therefore represent an accommodation between the different conflicting views. The debate and/or analysis both defines changes which would bring about improvement and seeks to motivate people to take action to implement the defined changes. This action includes local institution building or strengthening, so increasing the capacity of people to initiate action on their own.

Participatory learning methods

The participatory methods (sometimes called tools, techniques or instruments) used in these systems of learning and action can be structured into four classes: methods for group and team dynamics, for sampling, for interviewing and dialogue, and for visualisation and diagramming. It is the collection of these methods into unique approaches, or assemblages of methods, that constitute different systems of learning and action.

Participation calls for collective analysis. Even a sole researcher must work closely with local people (often called 'beneficiaries', 'subjects', 'respondents' or 'informants'). Ideally, though, teams of investigators work together in interdisciplinary and intersectoral teams. By working as a group, the investigators can approach a situation from different perspectives, carefully monitor one another's work, and carry out a variety of tasks simultaneously. Groups can be powerful when they function well, as performance and output is likely to be greater than the sum of its individual members. Many assume that simply putting together a group of people in

the same place is enough to make an effective team. This is not the case. Shared perceptions, essential for group or community action, have to be negotiated and tested. Yet, the complexity of multidisciplinary team work is generally poorly understood. A range of workshop and field methods can be used to facilitate this process of group formation.

In order to ensure that multiple perspectives are both investigated and represented, practitioners must be clear about who is participating in the data-gathering, analysis and construction of these perspectives. Communities are not homogenous entities, and there is always the danger of assuming that those participating are representative of all views. There are always differences between women and men, between poor and wealthy, between young and old. Those missing, though, are usually the socially marginalised (Guijt and Kaul Shah, 1996). Rigorous sampling is, therefore, an essential part of these participatory approaches, and a range of field methods is available.

Sensitive interviewing and dialogue are a third element of these systems of participatory learning. For the reconstructions of reality to be revealed, the conventional dichotomy between the interviewer and respondent should not be permitted to develop. Interviewing is, therefore, structured around a series of methods that promote a sensitive dialogue. This should appear more like a structured conversation than an interview.

The fourth element is the emphasis on diagramming and visual construction. In formal surveys, information is taken by interviewers, who transform what people say into their own language. By contrast, diagramming can give local people a share in the creation and analysis of knowledge, providing a focus for dialogue which can be sequentially modified and extended. Local categories, criteria and symbols are used during diagramming, which include mapping and modelling, comparative analyses of seasonal, daily and historical trends, ranking and scoring methods to understand decision-making, and diagrammatic representations of household and livelihood systems. Rather than answering questions which are directed by the values of the researcher, local people are encouraged to explore their own versions of their worlds. Visualisations, therefore, help to balance dialogue, establish rapport and increase the depth and intensity of discussion.

These alternative methodologies imply a process of learning leading to action. A more sustainable agriculture, with all its uncertainties and complexities, cannot be envisaged without a wide range of actors being involved in continuing processes of learning.

The spread and scaling up of sustainable agriculture

Despite the increasing number of successful sustainable agriculture initiatives in different parts of the world, it is clear that most of these are still only 'islands of success'. There remains a huge challenge to find ways to spread or 'scale up' the processes which have brought about these transitions.

Sustainability ought to mean, therefore, more than just agricultural activities that are environmentally neutral or positive; it implies the capacity for activities to spread beyond the project in both space and time. A 'successful' project that leads to improvements that neither persist nor spread beyond the project boundary should not be considered sustainable.

When the recent record of development assistance is considered, it is clear that sustainability has been poor. There is a widespread perception amongst both multilaterals and bilaterals that agricultural development is difficult, that agricultural projects perform badly, and that resources may best be spent in other sectors. Reviews by the World Bank, the EC, Danida and ODA have all shown that agricultural and natural resource projects both performed worse in the 1990s than in the 1970s-1980s and worse than projects from other sectors (World Bank, 1993; Pohl and Mihaljek, 1992; EC, 1994; Danida, 1994; Dyer and Bartholomew, 1995). They

are also less likely to continue achievements beyond the provision of aid inputs.

A recent analysis of 95 agricultural project evaluations logged on the DAC-OECD database shows a disturbing rate of failure, with at least 27% of projects having non-sustainable structures, practices or institutions, and 10% causing significant negative environmental impact (Pretty and Thompson, 1996).

This empirical evidence of completed agricultural development projects suggest four important principles for sustainability and spread:

1. Imposed technologies do not persist: if coercion or financial incentives are used to encourage people to adopt sustainable agriculture technologies (such as soil conservation, alley cropping, IPM), then these are not likely to persist.
2. Imposed institutions do not persist: if new institutional structures are imposed, such as cooperatives or other groups at local level, or Project Management Units and other institutions at project level, then these rarely persist beyond the project.
3. Expensive technologies do not persist: if expensive external inputs, including subsidised inputs, machinery or high technology hardware are introduced with no thought to how they will be paid for, they too will not persist beyond the project.
4. Sustainability does not equal fossilisation or continuation of a thing or practice forever: rather it implies an enhanced capacity to adapt in the face of unexpected changes and emerging uncertainties.

Most agricultural development programmes have begun with the notion that there are technologies that work, and it is just a matter of inducing or persuading farmers to adopt them. Yet few farmers are able to adopt whole packages of conservation technologies without considerable adjustments in their own practices and livelihood systems. To some, this may not be a problem; to the majority, it is a major impediment to adopting conservation technologies and practices.

The problem is that the imposed models look good at first, and then fade away. Alley cropping, an agroforestry system comprising rows of nitrogen-fixing trees or bushes separated by rows of cereals, has long been the focus of research (Kang et al, 1984; Attah-Krah and Francis, 1987; Lal, 1989). Many productive and sustainable systems, needing few or no external inputs, have been developed. They stop erosion, produce food and wood, and can be cropped over long periods. But the problem is that very few, if any, farmers have adopted these alley cropping systems as designed. Despite millions of dollars of research expenditure over many years, systems have been produced suitable only for research stations (Carter, 1995).

There has been some success, however, where farmers have been able to take one or two components of alley cropping, and then adapt them to their own farms. In Kenya, for example, farmers planted rows of leguminous trees next to field boundaries, or single rows through their fields; and in Rwanda, alleys planted by extension workers soon became dispersed through fields (Kerkof, 1990).

But the prevailing view tends to be that farmers should adapt to the technology. Of the Agroforestry Outreach Project in Haiti, it was said that *Farmer management of hedgerows does not conform to the extension program Some farmers prune the hedgerows too early, others too late. Some hedges are not yet pruned by two years of age, when they have already reached heights of 4-5 metres. Other hedges are pruned too early, mainly because animals are let in or the tops are cut and carried to animals ... Finally, it is very common for farmers to allow some of the trees in the hedgerow to grow to pole size (Bannister and Nair, 1991).*

Farmers were clearly adapting the technology to suit their own needs.

Enhancing farmers' capacity to innovate

Important evidence comes from a variety of soil conservation and agricultural regeneration programmes in Central America (Bunch and López, 1994). The Guinope (1981-89) and Cantarranas (1987-1991) programmes in Honduras and the San Martin Jilotepeque programme in Guatemala (1972- 1979) were collaborative efforts between World Neighbours and other local agencies. All began with a focus on soil conservation in areas where maize yields were very low (400 to 660 kg/ha), and where shifting cultivation, malnutrition, and outmigration prevailed. All show the importance of developing resource-conserving practices in partnership with local people.

There were several common elements. All forms of paternalism were avoided, including giving things away, subsidising farmer activities or inputs, or doing anything for local people. Each started slowly and on a small scale, so that local people could meaningfully participate in planning and implementation. They used technologies, such as green manures, cover crops, contour grass strips, in-row tillage, rock bunds and animal manures, that were appropriate to the local area, and which were finely-tuned through experimentation by and with farmers. Extension and training was done largely by villager farmers who had already experienced success with the technologies on their own farms.

Each programme substantially improved agricultural yields, increasing output per area of land from some 400-600 kg/ha to 2000-2500 kg/ha. Altogether improvements have been made in some 120 villages. Over time, soils were not simply conserved but regenerated, with depth increases from 0.1 metres to 0.4 - 1.3 metres not uncommon.

These programmes have also helped to regenerate local economies. Land prices and labour rates are higher inside the project areas compared with outside. There are housing booms, and families have moved back from capital cities. There are also benefits to the forests. Farmers say they no longer need to cut the forests, as they have the technologies to farm permanently the same piece of land. Before the programmes, national park authorities sought to keep villagers out of the forests; now there is no such concern since the forests are no longer threatened.

There are few published studies that give evidence of impacts years after outside interventions have ended. In 1994, however, staff of the Honduran organisation COSECHA (Asociación de Consejeros una Agricultura Sostenible, Ecológica y Humana) returned to the three programme areas, and used participatory methods with local communities to evaluate subsequent changes (Bunch and López, 1994).

They first divided all 121 villages into three categories, according to where they felt there had been good, moderate and poor impact. Twelve villages were sampled from these - 4 from each programme comprising one of the best, two of the moderate and one poor. These villages had some 1000 families (with a range of 30 to 180 per village). The first major finding was that crop yields and adoption of conserving technologies had continued to grow since project termination (Table 2).

Table 2. Changes in adoption of resource-conserving technologies, maize yields, and migration patterns in three programmes in Central America during and after projects

	At Initiation	At Termination ¹	In 1994
<i>No. of farmers with technologies</i>	.	.	.
Contour grass barriers	1	192	280

Contour drainage ditches	1	253	239
Contour rows	0	100	245
Green manures	0	35	52
Crop rotations	12	209	254
No burning fields or forests	2	160	235
Organic matter as fertilizer	44	195	397
<i>Yields of maize (kg/ha)</i>			
1. San Martin, Guatemala (1972-79)	400	2500	4500
2. Guinope, Honduras (1981-89)	600	2400	2730
3. Cantarranas, Honduras (1987-91)	660	2000	2050
<i>Migration (no. of households)</i>			
1. San Martin -	.	.	.
San Antonio Correjo	65	nd	4
Las Venturas	85	nd	4
2. Guinope: 3 villages	38	0	(2) ²
3. Cantarranas: 3 villages	nd	10	(6) ²

¹ Termination dates were: San Martin 1979; Guinope 1989; Cantarranas 1991.

² (2) and (6) refer to negative outmigration, ie families returning to their villages.
nd = no data

Source: Bunch and López, 1994

Surprisingly, though, many of the technologies known to be 'successful' during the project had been superseded by new practices. Had the original technologies been poorly selected? It would appear not, as many that had been dropped by farmers are still very successful elsewhere. The explanation would appear to be that changing external and internal circumstances had reduced or eliminated their usefulness, such as changing markets, droughts, diseases, insect pests, land tenure, labour availability, and political disruptions.

Altogether, some 80-90 successful innovations were documented in these 12 villages. In one Honduran village, Pacayas, there had been 16 innovations, including 4 new crops, 2 new green manures, 2 new species of grass for contour barriers in vegetables, chicken pens made of king grass, marigolds for nematode control, use of lablab and velvet bean as cattle and chicken feed, nutrient recycling into fishponds, human wastes in composting latrines, napier grass to stabilise cliffs, and home made sprinklers for irrigation.

Technologies had been developed, adopted, adapted and dropped. The study concluded that the half-life of a successful technology in these project areas is 6 years. Quite clearly the technologies themselves are not sustainable. As Bunch and López have put it *What needs to be made sustainable is the process of innovation itself!*

Towards a new professionalism

The central concept of sustainable agriculture is that it must enshrine new ways of learning about the world. Such learning should not be confused with 'teaching'. Teaching implies the transfer of knowledge from someone who knows to someone who does not know, and is the normal mode of educational curricula (Argyris et al, 1985; Bawden, 1992; Pretty and Chambers, 1993). Universities and other professional institutions reinforce the teaching paradigm by giving the impression that they are custodians of knowledge which can be dispensed or given (usually by lecture) to a recipient (a student). Where teaching does not include a focus on self-development and enhancing the ability to learn, then *"teaching threatens sustainable agriculture"* (Ison, 1990).

A move from a teaching to a learning style has profound implications for agricultural

development institutions. The focus is less on what we learn, and more on how we learn and with whom. This implies new roles for development professionals, leading to a whole new professionalism with new concepts, values, methods and behaviour (Table 3).

Typically, normal professionals are single-disciplinary, work largely in ways remote from people, are insensitive to diversity of context, and are concerned with themselves generating and transferring technologies. Their beliefs about people's conditions and priorities often differ from people's own views. The new professionals, by contrast, make explicit their underlying values, select methodologies to suit needs, are more multidisciplinary and work closely with other disciplines, and are not intimidated by the complexities and uncertainties of dialogue and action with a wide range of non-scientific people (Pretty and Chambers, 1993; Pimbert and Pretty, 1995).

Table 3. Towards a new professionalism for sustainable agriculture

Elements	Components of the new professionalism
Assumptions about reality	The assumption is that realities are socially constructed, and so participatory methodologies are required to relate these many and varied perspectives one to another.
Underlying values	Underlying values are not presupposed, but are made explicit; old dichotomies of facts and values, and knowledge and ignorance, are transcended.
Scientific	The many scientific methods are accepted as complementary; with reductionist science for well-defined problems and when system uncertainties are low; and holistic and constructivist science when problem situations are complex and uncertain.
Who sets priorities and whose criteria count?	A wide range of stakeholders and professionals set priorities together; local people's criteria and perceptions are emphasised.
Context of researching process	Investigators accept that they do not know where research will lead; it has to be an open-ended learning process; historical and spatial context of inquiry is fundamentally important.
Relationship between actors and groups in the process	Professionals shift from controlling to enabling mode; they attempt to build trust through joint analyses and negotiation; understanding arises through this interaction, resulting in deeper relationships between investigator(s), the 'objects' of research, and the wider communities of interest.
Mode of professional working	More multidisciplinary than single disciplinary when problems difficult to define; so attention is needed on the interactions between members of groups working together.
Institutional involvement	No longer just scientific or higher-level institutions involved; process inevitably comprises a broad range of societal and cultural institutions and movements at all levels.
Quality assurance and evaluation	There are no simple, objective criteria for quality assurance: criteria for trustworthiness replace internal validity, external validity, objectivity, and reliability when methods is non-reductionist; evaluation is no longer by professionals or scientists alone, but by a wide range of affected and interested parties (the extended peer community).

Source: Pretty, 1995b, adapted from Pretty and Chambers, 1993

But it would be wrong to characterise this as a simple polarisation between old and new professionalism, implying in some way the bad and the good. True sensibility lies in the way opposites are synthesised. It is clearly time to add to the paradigm of positivism for science, and embrace the new alternatives. This will not be easy. Professionals will need to be able to select appropriate methodologies for particular tasks (Funtowicz and Ravetz, 1993).

Where the problem situation is well defined, system uncertainties are low, and decision stakes are low, then positivist and reductionist science will work well. But where the problems are poorly defined and there are great uncertainties potentially involving

many actors and interests, then the methodology will have to comprise these alternative methods of learning. Many existing agricultural professionals will resist such paradigmatic changes, as they will see this as a deprofessionalisation of research. But Hart (1992) has put it differently: "*I see it as a 're-professionalisation'*, with new roles for the researcher as a democratic participant."

A systematic challenge for agricultural and rural institutions, whether government or non-government, is to institutionalise these approaches and structures that encourage learning. Most organisations have mechanisms for identifying departures from normal operating procedures. This is what Argyris et al (1985) call single loop learning. But most institutions are very resistant to double-loop learning, as this involves the questioning of, and possible changes in, the wider values and procedures under which they operate. For organisations to become learning organisations, they must ensure that people become aware of the way they learn, both from mistakes and from successes.

Institutions can, therefore, improve learning by encouraging systems that develop a better awareness of information. The best way to do this is to be in close touch with external environments, and to have a genuine commitment to participative decision-making, combined with participatory analysis of performance.

Learning organisations concerned with integrated farming will, therefore, have to be more decentralised, with an open multidisciplinary, and capable of responding to the demands and needs of farmers. These multiple realities and complexities will have to be understood through multiple linkages and alliances, with regular participation between professional and public actors. It is only when some of these new professional norms and practices are in place that widespread changes in the livelihoods of farmers and their natural environments are likely to be achieved.

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