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ISSUES AND CHALLENGES FOR FFS: An Introductory Overview

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Abstract

(257 words)

The paper attempts to give an introductory overview of some of the major issues and challenges that seem to require attention if the FFS tradition is to gain further ground. The paper starts off by reiterating the major differences between the collapsing transfer-of-technology paradigm that has so far guided thinking about agricultural development, and the FFS tradition. One of the main challenges for the future of FFS, also in terms of funding, is to tie it into the intellectual traditions of the new paradigm. The paper suggests how these might be further operationalised by FFS.

The paper continues by suggesting a number of derived issues and challenges. FFS is a form of adult education that can provide much needed human resource development to allow farmers and rural communities in developing countries to capture opportunities and respond to the changes foisted upon them by the global economy. Fully realising this potential is one of the key challenges that lie ahead. In facing this challenge, attention will have to be paid to the institutional support and the conducive policies that create the conditions for effective FFS at higher systems levels. A key issue in expanding FFS to other crops and topics is to maintain the social science focus on learning, empowerment and institutions, in addition to a strong science focus. Science linkage needs to be elaborated in recognising a new role for scientists and new types of agricultural research. Finally, expansion of FFS to more farmers requires a great deal more attention than it presently gets.

1. Introduction[1]

As an academic social scientist, I am extremely proud to be associated with the Farmer Field School tradition to the extent that I am asked to speak at a workshop where its members gather to take stock and chart the future. At the same time, given my professional background, I also feel a bit of a fraud. The people who did the work, who actually created the Farmer Field School as an operational approach in IPM, do not write about it. And thus they leave room for people like me to capture some of the glory they deserve. My only solace is that academics like me apparently are useful in helping practitioners 'understand what they are doing and why they should continue to do it' (Pontius et al, 2000). But that does not diminish my urge to express at the start of my paper my immense respect and admiration for the practitioners who had the creative genius and perseverance to develop the FFS as a concept and a practical approach. In my life-long search for alternatives to the ubiquitous conventional technology transfer approach, the FFS was the first real alternative that I encountered that has the potential of being applied on a large scale and yet satisfies some of the criteria that idealists had formulated for such alternatives. I consider myself first and foremost a co-traveller in the quest for improving the effectiveness and impact of FFS, not only in developing but also in industrial countries. It is against this background, that I will attempt to list some the challenges and issues that I consider central to the future development and growth of the FFS tradition.

My paper has the following outline (Table 1). I start off with a short restatement of what makes the FFS unique as an approach, as compared to technology transfer. In doing so, I hope to capture the key principles that should not be compromised when implementing FFS (items 1 and 2 in Table 1). I will then continue by linking the special features of the FFS approach into two of important 'narratives' that give strength to IPM-FFS' claim to be an effective alternative to ToT. In then pick up four additional narratives, to show how FFS has begun to link into progressive agendas of global importance. I will also show

[1] The author wishes to acknowledge the very helpful comments and suggestions by Dr Janice Jiggins.

how these need to be taken further. I will then raise two additional key issues and challenges that must be addressed to support the mainstreaming of the FFS approach.

Table 1. Major Issues and Challenges, Current Responses and Future Developments

Challenges	*IPM-FFS Response*	*Further Developments Desirable and Possible*
1. Participatory Development	Farmers are the experts IPM Farmers' Organisations	Semi-self-financing and self-financing options for FFS. Linking IPM Farmers Organisations and Consumer Groups
2. Adult Education	Linking with colleges, schools and ministries of education	Positioning FFS as an education investment Link to sustainable livelihoods analytic framework Emphasise development benefits of empowerment
3. Agro-Ecology and Sustainable Food and Ag. Systems	Agro-ecosystem analysis. 1st steps in environmental monitoring	Expand IPM-FFS alumni's role in monitoring GMO effects Creating IPM production to consumption food chains
4. Ethical Corporations	'Toxic Trails' video	Developing strategies to hold pesticide corporations and investment firms accountable for disclosing to financial markets full legal liabilities and risks of pesticide use
5. Institutional Support	Spreading 'ownership' to ministries of health, education and environment Co-financing with local government and others	Further testing of co-financing with local governments, supermarkets, and processors, using IPM standards. Stronger links with quadrant II and III scientists
6. Conducive Policies	Fair trade, social labelling, ecological and organic food labels Pesticide regulation. Bio-Safety	Link to water quality policy and service/supply agencies Link to food safety and food quality policies Link to trade regulations Link to bio-safety policies Link to farmers' IPR
7. Beta/Gamma and Science Linkage	Co-researching with decentralised R&D agencies	More explicit methodology/research process for curriculum development Further exploration of health and environmental 'social epidemiology' and surveillance
8. Coverage of Farmers	Community IPM	Eco-regional initiatives. Deliberate attention to processes of autonomous scaling up at the community level

II. THE KEY FEATURES THAT MAKE FFS SPECIAL

Comparison with the Transfer of Technology Paradigm

Table 2 highlights some key dimensions on which the transfer of technology and the FFS differ. Of course, such a table presents contrasting features to the extent that two 'ideal types' emerge. Notwithstanding the claims and excellent professional records of some extension practitioners to have engaged in what today is recognised as FFS 'best practice' (e.g., Vijverberg, 1996), I believe that my summary of the technology transfer approach adequately reflects the ideological core that has guided, and still guides, policy and investment in agricultural development.

Table 2: ToT and FFS compared on some key dimensions (based on Röling and Wagemakers, 1998)

	Transfer of Technology	*Farmer Field School*
Definition of Farmer	End user	Expert
Desirable Practices	Use of component technologies to control target variables	Management of the farm as an agro-ecosystem so as to enhance it's self-organisation
Learning required	Individual adoption of innovations	Group learning based on field observation and inference, and on experimentation. As long as the decision making process is right, the decision is right
Assumed autonomous scaling up mechanism	Diffusion of innovations among users	Spontaneous local dynamics started up by empowered FFS alumni
Facilitation required	Extension: transfer of knowledge by demonstration, lectures, etc.	Adult education: non-directive methods that energise and foster discovery learning
Institutional Support	Linear organisation of science-to-practice continuum so as to allow uninterrupted flow of technology from science to farmer	De-centralised organisation that allows making available process expertise and resources to foster local dynamics and farmer-driven FFS
Conducive policies	Support for R&D and extension services. Subsidies on input use. Treadmill policies	Abolish subsidies on input use. Support and finance for local dynamics and networking. Encourage farmer organisations and local R&D. Support of ecological (e.g. organic) food labelling and local markets

Technology transfer is based on three key assumptions:

(1) A positivist stance in science;
(2) The agricultural treadmill as the motor of agricultural development (Cochrane, 1958); and
(3) The diffusion of innovations as the key mechanism for scaling up impact (Rogers, 1995).

These key assumptions make transfer of technology much more than an extension approach. It is in fact a coherent paradigm that informs policy and investment and that is extremely difficult to dislodge because it is logic, its grounding in neo-classical economics and rural sociology, and its fit with an epistemology that many scientists still implicitly subscribe to. I will briefly describe all three, based on earlier work (Röling and Wagemakers, 1998; Cerf et al, 2000; Röling, 2002).

A realist and positivist stance assumes reality to exist independently of the human observer. This reality can be objectively known by using scientific research methods. Thus it is possible to build a body of true knowledge. Science is the growth point of this body of human knowledge. Development, therefore, results from a flow of technologies from scientists to users. Users learn by adopting such technologies. Other users see the benefits that arise from using and adopt also. This sets in motion a diffusion process among users that autonomously multiplies the impact of scientific progress. 'Diffusion works while you sleep'. An overly familiar story, I trust.

A special twist is the economic dimension of this model. Farmers can be regarded as constituting a population of relatively small firms that all produce the same product. Since not one of them can affect the price, they all try to produce as much as possible against the going price. This creates a downward pressure on prices. A new technology allows its early adopters to capture a windfall profit. However, others soon follow (diffusion) which increases the supply of the product or decreases its production costs. This leads to further downward pressure on prices. Those who have not yet adopted the new technology must now do so to keep up. Thus market forces begin to propel the

diffusion process. But investment in the technology is not as profitable as it was for the early adopters. Those farmers who are too small, poor, old, or ill to adopt the technology eventually drop out. Their land is absorbed by the ones who make the windfall profit. This process fuels scale-enlargement, intensification, and specialisation.

This summary makes it understandable why technology transfer thinking is so difficult to dislodge. Scientists love it because it puts them in a bankable glamour role. CGIAR propaganda speaks of 'cutting edge science to combat poverty'. Agricultural policy makers love it because it promises autonomous diffusion processes that give investment in research and extension a high internal rate of return to investment (Evenson et al, 1979), reduce food prices for consumers, render agricultural industries more efficient and competitive, and release labour from agriculture. It is small wonder that technology transfer has been and still is a dominant paradigm.

Before we become too convinced of its advantages and logic, I hasten to the reasons for the rapid rise in the number of its detractors and in the clout of arguments for its demise. It is a coherent paradigm that emerged in the typical historical conditions in Mid-Western states in the USA in the fifties and sixties (large homogeneous recommendation domains of specialised farmers). Right now, agriculture in that very area is in a deep malaise and serious doubts exist with respect to its future tenability (Blank, 1998). In both Europe and the US, this deep malaise occurs despite the huge subsidies that are needed to support farmers' incomes. Technology transfer contains the seeds of its own destruction.

- The constant price squeeze to which farmers are exposed forces them to accept methods of farming that are unsustainable, even in terms of maintaining their own natural and capital resources. Farmers are forced to 'stay in the market' by accepting the use of technologies and chemical products that reduce labour costs and increase production. They increasingly become dependent on external inputs and corporations that deliver these inputs or purchase farmers' produce. In the end, even those who usually are ahead of the pack cannot keep up.

- The dependence on dominant corporations and external inputs reduces the profitably of the entire farming sector, creates rural unemployment and undermines the viability of rural communities.
- The constant erosion of farmers at the tail in the end reduces the total number of active farmers so much that the treadmill mechanism is no longer operational. The driving forces, the windfall profits of the innovators and early adopters and the propulsion of the middle group by price squeeze, no longer work effectively.
- Globally, the treadmill mechanism exposes small farmers in developing countries to a global market in which conditions are set by highly productive industrial agricultural industries. This prevents developing countries from developing their own agricultural industries and enhances rural poverty and rural exodus.
- The global treadmill has created an agricultural industry that has shown to be unable to guarantee food safety, let alone food quality. It regularly gives rise to scares and crises, and allows diseases to erupt at a large scale with devastating consequences.
- It has become increasingly clear that bulk production of commodities for the world market is a dead-end road, a fact that is also recognised by such countries as France and Canada. At the time of writing, the collapse of coffee prices is a typical example of the effect of the global treadmill on agriculture. A focus on speciality products, diversification, niche markets and multi-functional agriculture is becoming the norm rather than the exception.

The Farmer Field School is not as yet embedded in a similar coherent narrative that combines economic, technological and policy arguments. I believe it will be necessary to develop such a narrative; this is the reason why I, in the next section, suggest four narratives with which the FFS approach seems to be consistent. Here it suffices to present some of the key ingredients of FFS as a policy approach:

(1). The farmer is an expert. FFS mobilise farmers' collective intelligence. Instead of being an 'end user', the farmer is a partner in the process of developing opportunity for innovation. In using the FFS approach, we are no longer relying on uniform technologies to blanket supposedly homogeneous recommendation domains; we seek instead to optimise diversity and local opportunity.
(2). Innovation through the FFS and discovery learning is not confined to component agricultural production technologies. It stretches to include innovative, ecological management (e.g., integrated nutrient management), community life and livelihoods, institutional change, and organisational development.
(3). The FFS approach highlights farmer observation and inference based on knowledge. It enhances preventive rather than curative measures and the use of natural processes rather than external chemical inputs and other quick fixes. Hence it seeks to reduce farmers' dependency on external inputs and corporations, and fosters an agro-ecosystem approach that leads farmers to be managers of self-organising complexity (e.g., use of natural enemies, recycling of wastes, etc.) rather than of simple mechanical systems.
(4). By paying attention to using natural processes, FFS instil an understanding of the polluting and toxic externalities of farming, and offer cost-saving technologies that mitigate the price squeeze to some extent.
(5). FFS do not rely on diffusion processes for scaling up. In fact, the complex expertise instilled by FFS seldom autonomously diffuses in its entirety. Scaling up of FFS impact depends on farmers who have been empowered by the group discovery learning process on which FFS is based, and who enrol others to benefit in a similar way. Thus FFS foster local dynamics that can counteract the global market forces that tend to plunge rural areas into misery. At best, FFS foster democratic forces, civil society, participation in scientific discovery and countervailing power against global corporations.

What are the narratives that could support further development of these features?

Participatory Development.

In the early seventies, researchers discovered that the sustainability of project outcomes correlated strongly with the extent to which the beneficiaries of the project had

contributed to the project and participated in decision making about it (Morss, et al, 1976). Later, it became increasingly clear that indigenous technology and local knowledge were indispensable allies in development effort. More recently, the crucial importance of 'ownership' in generating sustainable development has become widely accepted. As a result, participation has become a cornerstone of development policies and interventions (Pretty, 1994). Although participation in practice is not above criticism, it is worth noting that, in the North also, hard-headed planners, resource managers, engineers, and other professions also have begun working with participatory processes, because they lead to technically refined actions with lower social, political and economic costs.

It is now more commonly realised that agricultural R&D must be based in farmers' needs as much as it needs to be grounded in a review of the scientific literature. In one project in which I am involved, a prerequisite for any PhD study is a so-called diagnostic exploration that analyses stakeholders' needs with a view to grounding the research in demand[2]. Collaborative research with farmers and research driven by farmers ensures such grounding in local needs, but also incorporates local knowledge of conditions, including both knowledge of local ecosystems, weather, etc., and local insight in labour availability, fit with the local farming system, local markets, etc. In this respect, one can say that the FFS has a high potential for taking local needs into account. But such locally-driven demand is not automatic. FFS-based investments also can be used to promote practices that farmers are not in need of. A typical example is the attempt to focus IPM FFS on rice in Vietnam because the Government is keen to improve rice exports, while farmers feel that rice does not pay and are waiting for Government support in the production of fruits, vegetables and other higher value products (Linh, 2001).

[2] The project 'Conversion of Sciences' is financed by Wageningen University, the Dutch Development Agency DGIS and FAO's GIF. It tries to bring scientists, both from the natural and social sciences, as well as farmers together in IPM research. The reason for the launch of the project was the feeling that conventional science had little role to play in supporting FFS-type projects. Therefore, the CoS project deliberately seeks to experiment with forms of research that can be supportive of FFS. It is a project, therefore, that can be called research of agricultural research. It supports 4 Ghanaian, 4 Beninese and one Dutch PhD student. Precursors of the project were the published doctoral dissertations of F. Van Schouwbroek (2000) and A. Tekelenburg (2002). These dissertations pioneered respectively the diagnostic survey and the deliberate combination of (1) basic scientific research, (2) applied agricultural research, (3) development of systems that work, and (4) development of systems that are acceptable by stakeholders.

The recognised need for participatory development, and for devolving central government functions to local government, has generated a widespread shift to decentralised R&D and extension. The concrete practical design of this decentralisation is still 'under construction' in most countries.

FFS do or should help to operationalise the procedures supportive of decentralised agricultural development. However, a participatory approach can not be imposed through the method (Groot, 2002). A field school can be used both as a hoop for people to jump through and as a liberating experience. It can be an effective means both for the pesticide company that seeks to make farmers even more dependent on chemicals, as for the adult educator working for an NGO who genuinely wants to empower farmers. As we shall see, one of the real issues in FFS is to maintain discovery learning and non-directivity as essential elements in FFS implementation during scaling up.

Adult Education

FFS should not at all be defined only in terms of a non-formal method of education, whether this is described as extension or adult education. FFS is the operational dimension of a radically different way of thinking about land use and agricultural development. Having said that, we must accept that the way we frame this operational dimension is of great importance. Many of us still remember the effort of some World Bank employees to undermine the entire FFS approach as a fiscally non-sustainable form of extension which could better be replaced by other forms of mass demonstration (Quezon, et al, 2000). An important issue facing the FFS tradition is whether FFS are to be framed as an extension method at par with e.g., result demonstrations or field visits, or as a form of adult education.

I am convinced that FFS is not a form of extension at all, but that it must be seen as a form of agricultural education that develops 'human and social capital' while conserving 'natural capital' (see also FAO, 2001). Empowered, self-organising farmers in turn can become much more effective partners in extension.

In contrast to most industrial countries, developing countries have, on the whole, given very little attention to agricultural education. The agricultural education on offer usually is designed for induction training of future extension officers. In the present climate of privatisation and commercialisation, these training centres have often been turned into centres for training 'agricultural entrepreneurs'. This hardly addresses the needs of small farmers who increasingly face a need for continuing education. New forms of marketing and contract farming, issues of intellectual property rights, bio-safety concerns, credit use, input use, soil fertility management, a whole new range of crop cultivars (including GMOs), small-scale farm machines, and farm management, all require a grounding that goes beyond tacit knowledge and experiential learning. In most industrial countries, a great deal of attention is paid to agricultural education.

To my opinion, participating in a FFS provides a learning experience that represents a deep investment in human resource development that goes far beyond the temporary effect of an extension intervention. One can imagine a farmer over his/her life-time engaging in successive field schools, a form of life-long learning akin to an 'Open University'. Later on in the conference, a paper will be presented that assesses the present-day impact of a vegetable IPM FFS project held in the Gezira, Sudan, between 1993 and 1996. The results clearly show the continuing impact of the FFS experience on the participants as compared to non-participants, and implicitly, the lack of diffusion of practices from participants to others (Khalid, 2002, also Eveleens, et al, 2003, forthcoming). We need to do more long-term impact studies in support of this educational role of FFS.

It is an important challenge to firmly develop the adult education features of the FFS and to expand FFS as an operational approach to the kind of farmer education that a modernising sustainable agriculture requires.

III. FOUR ADDITIONAL NARRATIVES OF GLOBAL IMPORTANCE

1. Agro-ecological principles and sustainable agriculture (Item 3, Table 1).

Especially in industrial countries, the call for sustainable agriculture is becoming stronger. Important drivers are the increasing scarcity of clean drinking water, the search for safe and healthy food largely urbanised populations, and the prevention of food-based allergies, obesity, and other social ills that are the logical outcomes of agriculture driven by the treadmill. Exports to industrial countries increasingly require produce to be free from contamination by pesticide residues. These concerns of the North are not necessarily shared by developing countries. At the same time, it is realised also in developing countries that poverty, stress and alienation are strongly grounded in environmental degradation, including loss of soil cover, erosion, loss of soil organic matter, poisoning of drinking water by pesticides, and loss of bio-diversity (e.g., Van Haaften, 2002). Despite the potentially deep divisions between these perspectives, there are two narratives within agro-ecology and sustainable agriculture that could bridge the divide: IPM production-to-consumption and adaptive management.

IPM Production-to-consumption. The FFS approach, with its focus on farmers' observation and inference, and farmer experimentation, as well as its focus on the management of the farm as an agro-ecosystem and the use of biological processes provides a practical basis for supporting a more sustainable agriculture. In fact, it is but a small step from an IPM FFS to the collective certification of a group of farmers for export of biological agricultural products abroad (e.g., Lee, 2002, Pyburn, in prep.). An increasing number of international traders are interested in expanding Fair Trade labelling to include social and ecological values. And some international food processors, such as Campbell Soup or the UK-based Co-Op food retailer, have adapted IPM as

standard throughout the production-to consumption chains under their control because it pays them to do so (FAO, 2001).

Adaptive management. People have become a major force of nature and are affecting the face of the globe to an extent that seriously undermines the performance of ecological services on which we depend (Lubchenco, 1998). The solution, it is argued, lies in 'adaptive management', i.e., on the need for people to learn how to move away from controlling target variables in a linear fashion, toward forms of management that allow for the cyclical nature of ecosystems and the variable nature of the ecological services on which we depend (e.g., Holling, 1995). This so-called adaptive management is based on decentralised probing and exploration, and on teasing out human opportunity. It focuses on resilience in the face of surprises, and especially on the human ability to learn and to take concerted action. As fresh water, fisheries, forests, climate, soils, pollination by insects, viable human sperm, and other natural resources and ecological services become increasingly uncertain. The neo-classical economics perspective of ever-expanding human greed, and economic growth is beginning to look old-fashioned – and wrong[3].

FFS brings adaptive management into practice. It would not take much effort to tie FFS into this debate.

2. Ethical corporations (item 4, table 1)

I do not have to delve too deeply into the current stories on global corporations as robber barons on behalf of a small group of privileged share holders. The BBC series on 'The toxic trail' highlighted the corporate behaviours that are generating unacceptable 'public bads'. The PAN has for many years been active in tackling this agenda. There is scope to take another step, by linking issues of accountability in the pesticide industry to the growing concern of financial markets and the insurance industry to manage risk much

[3] As one example among many, the Head of the Water Department of the Province of North Brabant, the Netherlands, recently made this point explicitly in a presentation f water policy and policy implementation. (pers. com. Mrs Klitsie. The Provinciehuis, Den Bosch, 11-09-02)

more effectively. At a recent meeting[4], members of green investment funds, public interest lawyers, PAN, IPM scientists and policy researchers, among others, began to develop strategies to improve disclosure to investors, shareholders and market regulators the true extent of exposure to liability and risk that pesticide companies are incurring.

3. Institutional Support (item 5, Table 1)

Table 2 clearly shows the internal coherence among the dimensions that describe ToT and IPM FFS. The implementation of FFS asks for a totally different institutional support and policy environment than the institutional supports and policies demanded for transfer of technology.

I believe that the FFS tradition has not gone very far in specifying the nature of the institutional support and policies required for effective FFS at the field level. We are also not very good at the kind of argumentation and training required for moving officials, administrators and policy makers into supportive roles. It is increasingly clear that facilitation of local processes cannot ignore the higher levels at which conditions are set for local success (Groot, 2002). Ignoring those higher levels is acceptable as long as we are dealing only with the actions of local NGOs, or are implementing small-scale pilot efforts. However, as soon as we search for a larger scale implementation, for mainstreaming FFS, and for building it into national budget streams, district administrations and national line departments, we usually face serious difficulties in terms of incompatible policy frameworks and administrative practices. We should be developing very practical guidelines and training courses with respect to administrative and management practices at the district and national levels that are consistent with implementing IPM on the ground. I am convinced that we cannot leave the scaling up of IPM only to empowered and enthusiastic FFS alumni. FFS is very good at fostering such 'local dynamics' (Hounkonnou, 2001). But such dynamics need to be grounded in conditions created at higher levels.

[4] Reported in the Accountability of the Pesticide Industry, Report of a Meeting, 25-28 June 2002. The Rockefeller Brothers' Fund, New York.

IPM FFS has begun to recognise the challenge, by moving 'ownership' of IPM FFS into Ministries of Health, Education, and the Environment, to complement the agriculture sector's efforts. Practitioners also have begun experimenting with 'buy-in', inviting local governments and, where appropriate, also food processors and supermarkets, to part-finance the costs of running FFS, Community IPM, and District research facilities. A weak point in expansion of institutional support, however, remains that with 'science'. This point is further explored under section IV below.

4. Conducive Policy Frameworks (Table 1, item 6)

Regarding policy frameworks, let me be frank. I do not see much progress, or perhaps I should say, sufficient progress here. Although, recently, international policies have agreed to take some classes of persistent pollutants out of circulation, much remains to be done. At the same time, very powerful forces press for the removal of environmental and health 'restraints to trade' and the de-regulation of the agricultural industry world-wide. In the absence of effective capacity to licence, regulate, monitor, or to test the technical claims of commercial companies, trade policies could undo at a stroke the small policy gains that have been made.

What might be done? I suggest that IPM needs to lift itself beyond the Plant Protection sector, and forge evidence-based links with policies and agencies that deal with:

- Water quality. As potable water becomes *the* scarce resource over the next few decades, and as water supply becomes (in part) a privatised function, water companies are displaying strong interest in policies that require the removal of toxic pesticides from use;
- Food safety and food quality;
- Bio-safety;
- Farmers' intellectual property rights.

That is, IPM FFS needs to place itself among the actors who are setting the policy frameworks from which pesticide companies derive their 'licence to operate'.

IV. REMAINING CHALLENGES

FFS as a Beta-Gamma concern (Table 1, item 7)

FFS are linked in their history to IPM and bugs, even if the focus on low land rice has been expanded to include a wide variety of other crops. Administratively, FFS tends to end up in Departments of Plant Protection. The professionals associated with IPM tend to be entomologists. FFS, although the FFS agenda is expanding to other issues, such as soil fertility, and human health, remains sectoralised.

As I said at the beginning of my paper, I have deep respect for the people who have developed the FFS as a going concern. They were, to a large extent, technical scientists who understood that they could not be professionals in their respective fields without paying attention to the social processes (such as learning, conflict resolution, institutionalisation and organisation) that underpin the development and utilisation of knowledge. In my university, this understanding is characteristic for applied fields such as irrigation, forestry, soil science, entomology, nature conservation, and a host of other applied sciences that increasingly realise that one cannot train students without paying attention to these social process dimensions. In continental Europe this mix of technical science and attention to human process is called 'beta/gamma science', where *beta* refers to the technical and *gamma* to the social sciences.

FFS is an explicit expression of a beta/gamma perspective. It has to do with the interface between a community and natural resources, i.e., with land use. Land use has a technical science dimension, but also a social science dimension, expressed in institutions (such as land tenure) and processes (such as conflict, power, learning and innovation). A key and exciting social process that has emerged from the IPM experience is farmer empowerment. For some, empowerment has become even more important than IPM or other technical outcomes. In other words, the enthusiasm for social process can easily become dominant and disconnect FFS from its beta grounding.

I think that adequately dealing with the beta/gamma nature of FFS is a serious challenge. On the one hand, one is pressured to fit FFS into a technical box such as Plant Protection. On the other, FFS can become a method for empowering small farmers that is not rooted in some technical concern. In my view, as 'just another' approach to empowerment, FFS will fail if it loses its links with the applied sciences and social process. What are the key links?

(1). *Discovery learning*. Although this has not been 'proved' to everyone's satisfaction, it is generally accepted that the empowerment effect of the FFS is based on engaging farmers in a process of group discovery learning that allows them to make their own observations, draw their own inferences, and make their own informed decisions. I believe that the genius of the FFS curriculum is to create space exactly for this type of discovery learning. One of the real threats in expanding FFS to other crops and technical areas is that the focus will shift to 'getting it right', to 'telling 'em how it is', and to transferring 'correct scientific knowledge'. In this respect, trust in farmers making the right decisions often conflicts with the belief in the superiority of science and the need to 'tell 'em'. I believe that the great moment in FFS came when the scientific determination of spraying thresholds was left and farmers were left to make their own decisions as long as the process by which they arrived at these decisions was right. It is very difficult for an expert to take this attitude.

Curriculum development for new crops has to take such social aspects into account. If only for that reason, curriculum development itself must be participatory and also test whether the curriculum 'works' in terms of farmer learning. I believe that we have too little knowledge about the curriculum development process and about building in discovery learning and empowering experiences into the curriculum of an FFS.

(2). *Creating Systems That Work*. The success of IPM in rice FFS was based on a unique feature of the *sawa*. It is a thousand-year old farming system that is extremely robust (e.g., Settle, 2000). One can reduce pesticide spraying without serious consequences,

especially if one takes a number of preventive measures. Saving on pesticides and higher yields as a result of proper cultivation methods propagated in FFS made IPM worthwhile for farmers. Thus IPM in rice FFS satisfied the three important conditions for change: it has to be understood, it has to work and it has to be acceptable. In other words, farmers must know it, want it, and be able to do it. Scientists typically focus on developing systems that work according to their own criteria. One of the great discoveries of the last two decades is that scientists usually get it wrong when they assume farmers' criteria for acceptability (box 1).

> *Box 1: Soil Erosion Control* (based on Bensah, in prep.)
> Scientists designed important experiments in Ethiopia with respect to erosion control. They used food for work as an incentive to cover an entire watershed in Woleita with bunds and other devices for erosion control and installed an elaborate system to monitor run-off from fields and the entire watershed. The results were impressive in terms of reducing erosion. After the scientists left, a study was carried out to assess the extent to which farmers had maintained the control structures. In Woleita, these structures were largely removed. Farmers' reasons included: the structures harboured rats, provided sources of weed infestation, and prevented ploughing with oxen because fields had become too narrow. What is more, the farmers turned out not to be overly concerned with erosion. It was soil fertility they were worried about and the bunds hardly made any difference in that respect.

This means that FFS must not only develop systems that work, but above all systems that are acceptable and desirable by farmers. Ignoring this second aspect and using FFS to push scientist-based ideas down farmers' throats, is bound to give FFS as bad a reputation as transfer of knowledge. Especially if we want FFS to provide an alternative to technology transfer, to investors, shareholders and market regulators we must pay attention not only to what works but also to what is acceptable. This is an important challenge for the future of the FFS. It requires considerable investment in proto-type development and system design together with farmers.

Maintaining Science Linkage (Table 1, item 7)

One of the threats to FFS is that scientists do not see as clear a role for themselves in FFS as they see in technology transfer. I believe they are wrong. (But if they insist on 'telling farmers how it is', as described in the previous section, then they are right). The question then is, what kind of science? This question, and shared concern for the role of science in FFS, led FAO-GIF, the Dutch Secretariat General for Development Co-operation and my university to engage in a project called 'Convergence of Sciences' which aims to explore these questions (see footnote 1). It is a project that does research on agricultural research, and especially also on the types of agricultural research that together add up to a useful contribution to development. It is not an easy issue to address and requires considerable understanding of the nature of research. We have found figure 1 quite helpful.

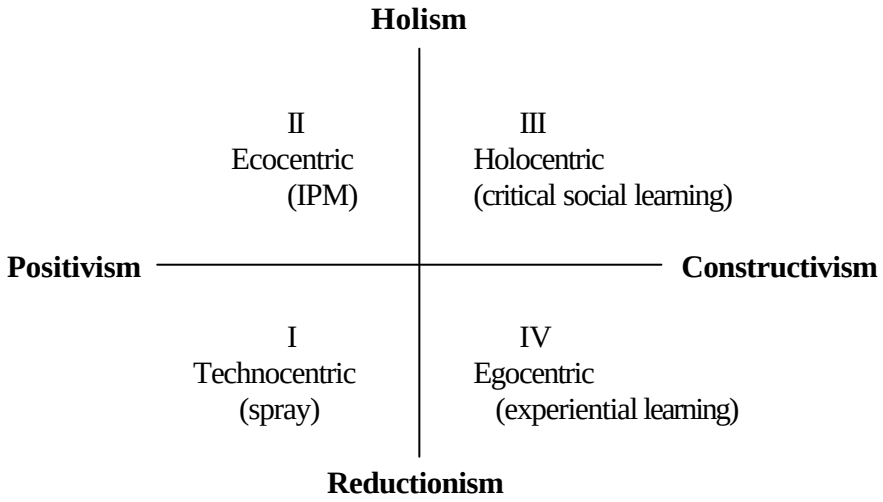

Figure 1: The Miller/Bawden Quadrants
(Based on Miller, 1983 and '85, and Bawden, 2000, and Baars, 2002)

It was developed by a Canadian named Miller, who wanted to understand the behaviour of his fellow scientists involved in combating the Spruce Budworm that infested the forests of New Brunswick at the time. In quadrant I he positioned the real 'hard' natural scientists who understand the world by reducing it to its components and believe in a single reality (theirs). Their advice was 'spray', i.e., control a single variable. In terms of

research, this quadrant represents reductionist basic, and reductionist applied research that respectively seeks to establish causal relationships and develop component technologies. Such research is at times, indispensable, to be sure. The problems with it derive from its dominance, and from regarding it as the only proper way of doing research.

Quadrant II is the home of 'hard systems' researchers, in this case people who want to manage the whole agro-ecosystem and seek to make use of biological controls, such as natural enemies. They represent the classic IPM approach. Research in this quadrant focuses on developing hard systems that work. In our experience in Wageningen (e.g., Van Schouwbroeck, 2000), it became clear that carrying out the basic and applied research, e.g., having established the life cycle, effective pheromones, food preferences, and natural enemies of a pest, does not in any way automatically lead to effective control of the pest. This requires additional research, with farmers, to establish effective systems that work in field conditions. This is not an extension task but an essential task of co-researching. Developing a system whose emergent property is a healthy crop is an exciting one for scientists, with many publishable offshoots, such as modelling studies, as well as for farmers.

Quadrant III introduces a new element: constructivism. Reality is no longer considered as externally existing irrespectively of the human observer. Instead, constructivism holds that people are doomed to live by constructing or bringing forth *a* (not *the*) reality as the basis for taking action (Maturana and Varela, 1992, Capra, 2001). They often get it wrong. In this view, science becomes a deliberate effort to construct a useful reality. Miller did not find many colleagues in Quadrant III. But the ones he did find emphasised human reasons as a key ingredient in the Spruce Budworm attack. The Budworm could become so devastating because paper mills had covered New Brunswick with uniform stands of spruce. In terms of research, Quadrant III focuses on developing systems that are acceptable by the stakeholders. As I indicated in the previous section, this is a crucial and indispensable aspect of effective agricultural R&D that is all too often overlooked (see also Tekelenburg, 2002).

Quadrant IV is not easy to visualise. Miller did not find any of his colleagues he could place in that quadrant. He suggested that 'pray' would perhaps be an appropriate action in that quadrant. Later, Baars (in prep.) suggested that this quadrant could appropriately refer to experiential research that focuses on the individual farm as a unique entity of knowledge integration, learning and action.

In all, the figure draws attention to the different types of research required for an effective FFS. All of them have their place, none of them is better than the other. But as long as scientists see themselves largely in Quadrant I, as sole harbingers of the truth and as sources of innovation which 'users' must apply, there is only limited room for formal science organisations in FFS. This does not diminish the importance of the contribution of Quadrant I type of research as one of the types of research necessary to support development. Quadrant I type of research can make important contributions in terms of identifying pheromones and natural enemies, elucidating life cycles, etc. One can suggest similar contributions for soil science, disease management, water management and so forth.

I believe scientists have a crucial role to play in FFS curriculum development, developing (with farmers) systems that work AND that are acceptable. This implies not just beta science, but especially also gamma science: the development of the required institutions, learning processes, labour deployment, etc.

In thinking about the role of science in FFS, I believe we must become more adept at distinguishing between the experimental work with farmers in farmer research groups, one of whose tasks is to develop curricula, and FFS based on those curricula. A FFS still uses farmer research, but it focuses on the discovery learning of farmers. Research with farmers to develop criteria focuses on learning of both scientists and farmers together. It is especially in the work with farmer research groups, i.e., in quadrant II and III type of research, that I see scientists can play important roles. One of the real challenges for the future of FFS is the further development of methodologies of science that address

quadrants II and III. This fits with the new roles that farmers and other stakeholders are seen to take in research. And it fits with the need to revamp most agricultural science as beta/gamma science. This leaves undiminished the usefulness of good old experimental, reductionist and positivist research – in its place.

I am of course aware of the great work a number of FFS enthusiasts have carried out especially in exploring the nature of research with farmers for FFS (e.g., Ooi et al, ****, Bruin and Meerman, 2001). It is now necessary to incorporate this type of research in the academic training of agricultural researchers.

Coverage (Table 1, item 7)

A key challenge to IPM FFS is: coverage. What part of the farming population is being reached? In the transfer of technology tradition, a great deal of attention has been focused on researching the diffusion of innovations. These studies established an entire research tradition that at one time formed the largest single body of empirical research in the social sciences. Its findings have, over the years, been ably synthesised in very readable handbooks by Everett Rogers (who was my PhD supervisor). I am therefore sensitive to the nature of coverage. I think it is an aspect that has been inadequately addressed in the FFS tradition.

I believe it is a sound working hypothesis that the complex lessons learned in FFS do not easily diffuse on their own, just as reading or arithmetic do not diffuse but have to learned in school by each child again. But this is a working hypothesis. It would be good to carry out more specific research into the spin-off effects of FFS.

Diffusion of Innovations research has made me highly aware also of the differences between farmers, not so much in terms of their innate 'innovativeness', but especially in terms of the extent to which they can access and/or use the technologies concerned (e.g., Röling, 1988). Most outcomes of diffusion research show that 'to he who has shall be

more given' [5]. In other words, the farmers with most access to land and capital and with the best education often are the ones who benefit most from new technologies and extension efforts to promote them. In fact, extension workers often follow a 'progressive farmer strategy', i.e., they deliberately target such farmers in the expectation that the innovations will diffuse from them to 'follower farmers'. The T&V system that used to be promoted by the World Bank was based on this strategy. The point is that there is no automatism in the diffusion of technology from 'contact farmers' to the 'followers'. More often than not, contact farmers pre-empt the development that new technologies offer.

Although I have positioned the FFS as adult education, these considerations are relevant to some extent to FFS. Who are the farmers that are selected for an FFS? Is one FFS per village enough for 'covering' the whole village? How can we ensure that others benefit from an FFS? What is the role of the 'empowered alumni' who are now seen as the route to scaling up FFS impact? Is community IPM a sufficient response to these questions? As far as I am concerned, alumni could well be village elites who see FFS as a means to strengthen their position and consolidate their power.

World Neighbours, among others, have pioneered procedures for the selection of those who are to be involved in a participatory research effort or trained in FFS from among a village community. I have not seen much work that seeks to make this selection a deliberate effort that involves the whole community or ensures that the selected farmers participate in the FFS on behalf of the whole community and therefore beholden to others to disseminate the results. Are the accountability mechanisms (of peer review, open days, house-to-house campaigns, etc.) so far developed sufficient. How else might the experience of FFS be extended to other members of an FFS community, and to other communities? The answers of course will depend in part on the social mechanisms and networks of a particular context, but it would be useful to have more, and more systematic, reviews of experience to draw on as guidelines.

[5] The Dutch call this 'the devil shits on the big pile'.

V. Conclusion

FFS is not an expensive extension method. It can more accurately be regarded as a long-term investment in human and social resource development that allows a nation's farmers and rural communities to capture the opportunities offered by ecological diversity and to mobilise the financial and organisational resources to deal on fair terms with policy makers and markets.

At the same time, FFS is more than a form of agricultural education and mobilisation. It can be seen to represent the practice of a new way of looking at agricultural development, that consistent with practices and policies, are slowly emerging out of the ruins of technology transfer and its conceptual grounding in positivist science, treadmill economics, and diffusion of innovations sociology.

I have suggested eight ways in which IPM-FFS could, perhaps must, develop its experience by taking up the challenge to link into wider networks of conversation, practice and policy development.

I think we face a unique historical opportunity to tie the FFS tradition into the wider debate about the future of agriculture, ecology and society. In its way, FFS offers the quintessence of the alternative future *'avant la lettre'*.

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