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FSR: Achievements, Deficiencies and Challenges for the 1990s

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ABSTRACT. Farming systems research (FSR) has been an important force in international agriculture for more than a decade. It has brought a series of fresh perspectives to agricultural research, but the characteristics that distinguish it from more conventional research are also a source of problems in fully utilizing the approach. FSR is responsible for significant changes in research management and has contributed to our understanding of farmers' priorities. The principal challenge for the future is to use FSR to improve the efficiency of entire research and extension organizations.

From its inception in the mid-1970s, Farming Systems Research (FSR) has progressed from a rough amalgam of ideas regarding technology generation and transfer to become a dominant concept in both the literature of agricultural development and the organization of agricultural research and extension projects. FSR can accommodate a wide variety of interests and has attracted considerable funding, but has produced an uneven record of accomplishment. On the one hand, FSR has made lasting contributions to the way agricultural research is conceived and organized, but on the other hand, it has led to some work that has been extravagant, impractical or divisive. This paper attempts to assess FSR's accomplishments and limitations, and suggests what the future might hold.

THE FSR PERSPECTIVE AND ITS LIMITATIONS

FSR is sensitive to the biological, economic and social factors that influence the management of farming systems. The practices, problems and interests of the farm household are incorporated into a research program in order to design technology

compatible with the farming system. The technology is then tested and assessed in farmers' fields under their conditions and using their criteria.

Thus, both the complexities of the system and the criteria of the farmer should play important roles in shaping the perspectives and methods that researchers employ. A wide variety of research strategies and projects has emerged from this view, and several attempts have been made to place them in some order. Merrill-Sands (1986) offers a classification with six types of activities that can be considered FSR. They range from efforts to merely describe the workings of particular systems, to broad-based rural development programs.

Simmonds (1985) divides the FSR universe into three types. Activities limited to the academic study of entire farming systems he calls "FSR *sensu stricto*." Research devoted to the development of entirely new systems to replace current practices is referred to as "new farming systems development." Finally, research that uses an understanding of the farming system to identify opportunities for introducing stepwise change to farming practices is called "on-farm research with a farming systems perspective." Although all three types have contributed to the development of FSR, it is the third that has absorbed the major amount of attention and resources, and is at the center of debates regarding the future of FSR in national programs. The remainder of this paper focuses on this class of research.

Despite the variety of approaches to FSR, most such work is distinguished by a set of research procedures that emphasizes the following activities:

- *Diagnosis or site description.* This includes various methods for describing the area where research is to be carried out, analyzing current farming practices and eliciting farmers' problems and interests.
- *Planning or technology design.* Diagnostic information is used to set research priorities, propose improved technologies and design an experimental program.
- *Testing.* The majority of the experimental work is carried out in farmers' fields. Experiments either serve a diagnostic function to further develop information about production problems, or test or verify new technological options under farmers' conditions.
- *Analysis.* Experimental results are assessed using formal technical and economic criteria, as well as assuring that the conclusions are compatible with farmers' concerns and the characteristics of the farming system.
- *Recommendation and extension.* Various methods are used to diffuse the research results.

Beyond sharing some common methodological ground, most FSR endeavors exhibit certain characteristics that help distinguish them from other types of agricultural research. An examination of some of these characteristics will help emphasize the particular contributions of FSR and at the same time illustrate some problems associated with it.

System orientation

Virtually all FSR is oriented by some reference to a farming system, but the suitable delineation of system boundaries has been problematic (Merrill-Sands 1986). Some FSR projects have been too ambitious in the conception of their responsibilities and have felt obligated to investigate a large number of farm enterprises at the same time. The impression that FSR *necessarily* involves studies of multiple cropping, crop-livestock systems or broader rural development issues has at times contributed to a breach between FSR activities and commodity or disciplinary research. This rupture has made commodity programs suspicious of data developed through FSR and given little encouragement for FSR to pursue research themes of value to commodity research.

Moreover, technology design is often most heavily influenced, not by the challenges and opportunities presented by local systems themselves, but rather by the "conventional wisdom" among senior research managers (and experts employed by donors and international agencies) regarding suitable styles of "systems" research. Claims of a systems orientation can quickly become somewhat hollow under these conditions.

Interdisciplinary

A concern with farming systems necessarily envisions the participation of various disciplines in the research effort. But achieving such interdisciplinarity has proven difficult, and many FSR efforts are dominated by either social or biological scientists. In some geographical regions, the major impetus for the development of the FSR concept came from the social sciences, and there FSR is often looked upon as being "a social scientist's invention" (Chambers and Jiggins 1986). In contrast, social science input in Asia is typically weak and sometimes entirely absent.

Location specific

FSR is usually carried out for a well-defined geographical area or research site. Such a strategy has obvious advantages for focusing on a system, as well as for coordinating work with extension. But too little attention has been paid to efficiency considerations in the size or distribution of locations for FSR. Exhaustive work is typically carried out in extremely small areas. Without thought to possibilities for extrapolation, such work may impose very high costs in terms of staff, vehicles and budgets. More attention needs to be given to developing mechanisms for coordinating and managing data developed in small "research sites" so that it can be used in larger "extrapolation areas" (Hudgens et al. 1987).

Resource-poor farmers

FSR has its origins in concerns about more equitable strategies for technology development, and the system focus is particularly appropriate to resource-poor farmers with heterogeneous enterprise patterns, resources and objectives. This has led, however, to some confusion between research methods and targets. Some opposition to FSR has been based on the perception that it is only a methodology for the most marginal of farmers. The principles and methods of FSR are applicable to a wide range of farming populations, and decisions regarding the utility of FSR must distinguish the choice of *clients* for agricultural research from the choice of appropriate *methods*.

On-farm

Most FSR activities are carried out in farmers' fields, but on-farm activity is not necessarily a sign of well-focused research. Experimentation under farmers' conditions is typically subject to more variability than station research and, unless it is well conceived and analyzed, may provide no useful information. On the other hand, much conventional experiment station research proceeds with little reference to the conditions and problems of client farmers. There is strong justification for doing as much work as possible under farmers' conditions. In many cases, however, FSR has not led research beyond the gates of the experiment station, but rather has contributed to the forming of two separate research camps, each contemptuous of the lack of rigor or relevance in the other's work.

Adaptive

FSR is often seen as a way of adapting technologies that are "on the shelf" to specific farming conditions, but there has not been sufficient attention given to the availability of technology. Some FSR efforts have assumed that goodwill and systems analysis are sufficient to bring productive innovations to difficult environments. There are many instances where technology still needs to be developed, where problems are sufficiently intractable that there are simply no available solutions. A farming systems perspective may often be more useful in guiding applied on-station research than attempting short-term interventions.

FSR IN PRACTICE

After more than a decade of prominence in the literature and budgets of agricultural development, FSR is beginning to lose some of its luster. This section describes areas in which FSR has made strong contributions and points to other areas where

it has not fulfilled the (admittedly high) expectations of research managers and donors.

The principal contributions of FSR to strengthening agricultural research have been in the areas of research orientation, methods and organization. FSR has been responsible for significant changes in the way research is conceived and carried out. The introduction of FSR, under various guises, has altered the way researchers look at their clients. The force of the FSR movement has led both its supporters and detractors to pay more attention to the conditions and problems of resource-poor farmers. FSR can take some credit for the fact that an increasing number of national program researchers can provide good descriptions of local farming practices, explain their rationale and offer examples of how technology must be tailored to farmers' needs. Much work remains to be done, but research is gradually being weaned away from a "transfer of technology" view to a more farmer-centered orientation.

FSR has motivated an immense amount of work on field research methods, and although this has been accompanied by an inevitable profusion of jargon and a number of false starts, the net result has been positive. FSR provides an alternative to formal survey methods applied in a mechanical fashion to diverse farming situations. One of the most significant contributions has been the idea of initiating research with an informal survey (Collinson 1981) or *sondeo* (Hildebrand 1981), which places an interdisciplinary group of researchers in the field for several days, talking to farmers, observing their fields, and gradually building up a set of hypotheses about local practices and problems. This technique has been widely adopted and represents part of a wider interest in development planning in "rapid rural appraisal" (Carruthers and Chambers 1981). A review of FSR projects would reveal a range of survey techniques employed, from exclusive reliance on informal surveys to extensive multiple-visit questionnaires. But there is a definite trend towards more efficient problem-oriented survey techniques (Byerlee et al. 1980) and towards a farmer focus, including more attention to the advantages of using farmer groups to help set research priorities (Ashby et al. 1987) and monitor experimental work (Norman et al. 1988).

Although researchers have been planting trials and demonstrations in farmers' fields for decades, FSR has developed and promoted a much more rigorous approach to the planning and analysis of on-farm experiments. Guidelines help researchers identify priority factors for on-farm experiments (Tripp and Woolley 1989). Work on rice-based cropping systems produced a methodology for the design and management of cropping pattern testing (Zandstra et al. 1981). Experience with on-farm experiments has led to new ideas regarding appropriate designs and analytical techniques for assessing technologies under farmers' conditions (Woolley 1987). More attention has also been given to the possibilities of farmer-managed experiments (Lightfoot and Barker 1988) and the role of farmers in setting

experimental parameters (Sumberg and Okali 1988). In addition, methods are well established for the economic analysis of on-farm experiments (CIMMYT 1988).

FSR has also contributed to changes in the organization of agricultural research, particularly in the development of relations with extension and the participation of the social sciences. Because it tends to be location-specific, FSR has opened up many more possibilities for collaboration between research and extension. Much remains to be done, however, in coordinating the work of extension agencies divided by administrative boundaries, and research institutions organized around agroecological and/or socioeconomic targets. FSR has also brought about a significant change in the role of social science in agricultural research, and a shift towards ex ante participation in the identification of the research agenda (Byerlee and Tripp 1988). This includes not only an expanded role for agricultural economics, but also an increasing recognition of the contribution of other social sciences in defining research problems and organizing field research (IRRI 1982; Rhoades 1984).

FSR has not only contributed to changes in the orientation, methods and organization of agricultural research, it has also led to the development of useful technologies for farmers. Location-specific on-farm research, carried out by national program and international agricultural research center staff, has brought new technology to farmers in Panama (Martinez and Sain 1983), Indonesia (Dahlan et al. 1987) and Ghana (Tripp et al. 1987). The work of the Asian Rice Farming Systems Research Network, sponsored by the International Development Research Centre (IDRC) and coordinated by the International Rice Research Institute (IRRI), has been instrumental in fostering the intensification of rice-based cropping patterns in several Asian countries, including the Philippines (Morris 1984), Indonesia (Siwi et al. 1986) and Nepal (Mathema 1986).

But even taking account of the time required for technology development and the effort required to establish a new orientation to research, the current assessment must be that *FSR has not yet repaid its intellectual and financial investment with increases in productivity for resource-poor farmers.* The earlier promise of FSR – rapid and wide-ranging adoption of suitable new technology by representative farmers – has clearly not been met. The limited number of success stories to date gives cause for serious concern about the future of FSR.

FSR IN THE 1990s

As FSR enters the 1990s, it is a good time to encourage practitioners to take stock of accomplishments and to think carefully about how FSR can make a more substantial contribution to improving rural welfare. FSR is no longer the fashionable theme that it once was, and is attracting increasing skepticism, especially

among donors. On the other hand, FSR is well established in many national research programs, and a solid base of experience has been developed. It is important that this experience be utilized for improving the efficiency of agricultural research in general.

The following suggestions for the future of FSR are derived from a review of the literature and from an analysis we are currently carrying out of successful FSR projects, i.e., those that have led directly to farmer adoption of new technology. The themes are drawn from a wide range of concerns that affect the implementation of FSR. Some are concerned with the conduct of FSR, including the choice of appropriate methods and the issue of farmer participation. Others concern the relations between FSR and the institutional environment, particularly extension and policy formulation. In addition, there are concerns about the way progress is assessed, including the emphasis on technological change and the burgeoning interest in sustainable agriculture. Finally, although each concern has merit, we feel that strengthening the organization and management capacities of national research and extension systems is the most important prerequisite for improving the efficiency of FSR.

Choice of FSR methods

FSR provides an opportunity to examine a wide variety of issues, and there is the temptation to explain lack of success by the failure to employ a particular sequence of methods associated with a particular "approach" to FSR.

The wide variety of research methods and terminology associated with FSR can to some extent be explained by the varied conditions under which the different approaches to FSR were originally developed (Harrington et al. 1989). The IRRI cropping systems methodology, for instance, was directed at intensifying cropping patterns in lowland Asia where rice was the only appropriate crop during the wet season, and where the introduction of early-maturing photoperiod-insensitive rice varieties had increased the time available for upland crops either before or after the main rice crop. This led to emphasis on cropping patterns as the major unit of analysis.

Much of the early work on what has come to be called "on-farm research," on the other hand, was carried out in rainfed areas where no single crop was dominant. It is not surprising that a different set of methods evolved. Harrington et al. place particular emphasis on the similarities among these methods, however. They urge a more pragmatic approach to FSR, where methods and procedures are selected according to their utility rather than because of their place in one or another research scheme. Our review has shown that in most cases of successful FSR, researchers were more eclectic in their choice of research methods than we had

expected. It is time that a truce was called in the methodological and terminological warfare that has characterized FSR.

Farmer participation

An alternative to researchers studying the complexities of farming systems in more depth is to provide more opportunity for farmers to direct and carry out research. A growing interest in farmer participation in research (Chambers and Jiggins 1986; Farrington and Martin 1988) stems partially from an assessment that although FSR promised to "give voice" to small farmers (Norman 1980), much FSR has rendered only superficial attention to farmers' interests. Beyond this, there is the feeling that fitting complex technologies to heterogeneous environments requires more decisionmaking in the hands of farmers (Sumberg and Okali 1988).

Our review of successful cases of FSR shows a very high degree of farmer involvement throughout the research process. In many instances, experiments that involved significant farmer management were the key to refining the technology. Even when experiments were more in the hands of researchers, farmers often made important adjustments to the technology.

Extension

Although one of the justifications for FSR has been to forge better links between research and extension, there are relatively few examples of effective collaboration. Training and Visit (T&V), a major effort at organizing extension promoted by the World Bank (Benor and Harrison 1977), was developed independently of FSR, with few obvious connections. T&V assumes that technology is available to farmers and that the critical factor is the organization of clear extension messages and methods for delivering them. However, there are too many cases where FSR has not yet developed a backlog of technology for delivery, and extension has not yet accepted that effective transfer of technology often begins with a better understanding of clients' needs. Thus, there remains much room for improvement on both sides.

One place to start is by developing stronger research-extension linkages and more direct participation of extension staff in the technology generation process. Recent research at the International Service for National Agricultural Research (Ewell 1989; Kaimowitz 1990) has shown the importance of linkage mechanisms in achieving better collaboration between research and extension. These mechanisms might include joint surveys or planning sessions, staff rotation or liaison officers. The review of successful FSR showed that in no case was there significant adoption of new technology developed by FSR without an extension effort of some kind, in some cases organized by the researchers themselves.

Policy

FSR has at times been encouraged to include wider policy issues within its purview (Davidson 1987). Although technology generation must depend on the provision of rural infrastructure, markets and appropriate pricing policies, such issues are beyond the reach of what is essentially a set of methods for location-specific research. Data from on-farm research can be useful for contributing to policy formulation or implementation (Yates et al. 1988), but FSR must see itself as part of a larger policy framework rather than the other way around. Every location, farming population or production problem is not automatically a candidate for FSR, and targets must be chosen in the context of policy priorities and constraints. An emphasis on marginal environments, for instance, may direct research resources to areas where agriculture is not a primary determinant of welfare and may divert attention from populations that merit a higher priority (Reardon et al. 1988).

Monitoring technological change

In our attempt to document and analyze successful cases of FSR, one of the most disturbing findings was the lack of follow-up in many FSR projects. Although exhaustive diagnostic studies may be carried out at the initiation of an FSR effort, it is rare to find simple monitoring surveys to assess the degree to which farming practices have changed, either due to the research effort or because of other factors. This lack of attention to results and progress seems to belie FSR's interest in bringing useful technologies to farmers. Less attention should be given to system description and repetitious sets of trials; there should be more commitment to following up and assessing technological change for target populations.

Sustainable agriculture

To the extent that FSR was able to encapsulate a number of concerns and capture the interest of donor and scientific communities in the 1970s and 80s, its successor for the 1990s is likely to be the theme of sustainability (Davis and Schirmer 1987). Although it is true that FSR has placed particular emphasis on developing technologies acceptable to farmers using short-term criteria, it is not likely that sustainability issues can be addressed by ignoring the experience of FSR. Many leading advocates of sustainable agriculture have backgrounds in disciplines – ecology, forestry, natural resources – that historically have not been central players in the FSR movement. Thus, the notion that the lessons painfully acquired by FSR may be ignored is not altogether trivial. Indeed, until national agricultural research systems (NARS) efficiently incorporate farmers' criteria into technology design and test technologies under farmers' conditions, it is not likely that they will be able

to address the exceptionally difficult problems associated with research on the longer term sustainability of alternative practices or systems.

Research organization

The greatest challenge for FSR in the 1990s, and the only hope for taking full advantage of its contributions, is for it to find its place in the context of the entire agricultural research organization. FSR has brought a strong client orientation to agricultural research and has a whole range of research procedures to help design technologies for well-defined groups of farmers. This perspective and these methods must now be incorporated in the work of the wider research institution.

Such incorporation has been difficult until recently because FSR has tended to be seen as a separate entity, complementary to or competitive with other research activities. In addition, the variants of FSR have been presented as rigid sets of steps, complete with their own procedures and vocabulary, and research organizations have been forced to choose among them. The urgency of looking for a common ground in FSR has been recognized (ICRISAT 1987), and there is strong evidence that it exists.

The farmer focus of FSR is also of crucial importance in developing a research agenda. The results of location-specific research need to be channeled through a strong research organization that can collate information generated at the local level and use it to set priorities for applied disciplinary and commodity research (Byerlee et al. 1986; Merrill-Sands and McAllister 1988). Mainstream agricultural research organizations need to decide how to target their scarce resources towards important problems and priority farm populations. The perspective and methods of FSR can play an important role in that task.

CONCLUSIONS

The FSR movement has focused attention on resource-poor farmers as clients for agricultural research. It has placed FSR practitioners in much closer contact with farmers and has provided a wide variety of innovative research methods to help understand farmers' priorities and test and assess technologies under farmers' conditions and criteria.

But FSR has often been implemented inefficiently within NARS, with little thought to clear definitions of staff responsibilities, interdisciplinary communication, or the setting of research priorities within the larger institution. The consequence has been a much slower rate of technology generation than expected, and often a perceived split between systems researchers on the one hand, and commodity and disciplinary researchers on the other.

One principal challenge for the 1990s is to use the perspective and methods of FSR to improve the efficiency of commodity and disciplinary research. The other challenge is for FSR to substantially upgrade its own efficiency, so that it can finally begin to repay, through increases in productivity for resource-poor farmers, what has been invested in it.

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