THE FARMING SYSTEMS APPROACH:
A HISTORICAL PERSPECTIVE [1]

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INTRODUCTION

Prior to the mid-1960's, active research collaboration between technical agricultural scientists (i.e., mainly working on experiment stations), agricultural economists (i.e., mostly in planning units) and anthropologists/rural sociologists (i.e., generally in academia), was limited. By the mid-1960s, the Green Revolution was beginning to have a major impact on crop production in parts of Asia and Latin America through the introduction of fertilizer-responsive, high-yielding varieties of rice, wheat, and maize in favorable and relatively homogeneous production environments where there was assured soil moisture, good soils, ready access to cheap fertilizer, and relatively efficient output markets. However such conditions did not exist in most of Sub-Saharan Africa and in certain parts of Latin America and Asia, and as a result, these areas were bypassed.

The reductionist approach failed in terms of developing technologies for resource-poor farmers in less favorable heterogeneous production environments or agricultural areas. This led to the incorporation of a systems perspective in the identification, development, and evaluation of relevant improved technologies. Hence in the mid to late 1970s, the farming systems research (FSR) approach evolved, a basic principle of which was the need to create new types of partnerships between farmers and technical and social scientists.

FSR thus became very popular with donor agencies, to the extent that, by the mid 1980s, about 250 medium- and long-term externally funded (i.e., in addition to those domestically funded) projects worldwide were implementing FSR-type activities. Between 1978 and 1988, USAID[2] alone had funded 76 bilateral, regional, and centrally funded projects containing a farming systems orientation. Forty-five of these were in Africa. Most of these projects supported the establishment of separate FSR units, which often were poorly integrated into, or poorly linked to, mainstream technology development activities. Although it is probably true to conclude that few of these projects succeeded in producing new technologies that were widely adopted, the approach of looking at farmers' constraints and needs for technical change from within was eventually mainstreamed into most national and international agricultural research programs by the late 1980s. Therefore although donor support for supporting explicit FSR activities dwindled towards the end of the 1980s, most national agricultural research systems (NARS) had adopted major components of the FSR philosophy and approach, and the spirit of the FSR approach lived on.

Since then there has been considerable evolution in the methodologies employed (e.g., new farmer participatory research (FPR) techniques, gender analysis, environmental impact analysis, and statistical techniques adapted to on-farm research). Also participation has been broadened to include a wider set of agricultural stakeholders, including extension,[3] development, and sometimes even

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2 The University of Florida played a very significant function during much of this period in providing a backstopping/supportive role for USAID FSR related projects via their Farming Systems Support Project (FSSP) which was funded by USAID.

3 Hence the name farming systems research and extension (FSRE) that was popularized by Peter Hildebrand and his colleagues at the University of Florida.

planning/policy staff.[4] Perhaps even more significant has been incorporating the underlying principles of the farming systems approach into the priorities of donors and nationally based agricultural programs. These include increasing emphasis on participatory approaches and empowerment of farmers and their families and a new focus on ecological sustainability and sustainable livelihoods. Although appropriate technologies still are viewed as important catalysts for improving farmers' welfare, the criteria for relevancy have become more clearly defined and specific.

In this paper I summarise how the farming systems approach that has evolved over the last 30 years with a very brief indication of the factors that contributed to bringing about those changes.[5] A key dimension of that evolution has been the way the scope or inclusiveness of a systems perspective has been expanded systematically over time. "The way in which the systems perspective is implemented, in particular the scope or inclusiveness of the systems analysis, depends on how, for any given problem, researchers define the ratio of variables to parameters; or put another way, which factors are considered endogenously determined and thus subject to analysis and modification, and which are taken as exogenously determined constants. Because of the analytical difficulties of simultaneously handling large numbers of variables, most of the early FSR programs took only incremental steps away from traditional reductionist approaches by limiting the number of variables they studied and by regarding the other factors that influence the farming system as parameters or constants. As analytical methods have grown more sophisticated, and particularly as farmers have become active partners in the analysis, the ratio of variables to parameters has increased, and the analytical domain has expanded considerably" [Norman and Matlon, 2000].

This evolutionary process is operationally summarized in four phases in Figure 1 [Norman and Lightfoot; Norman and Matlon, 2000]. The important point to bear in mind is that moving progressively through the four phases means dealing with a progressively higher ratio of variables to parameters. This has become feasible through the development of analytical methods that can handle increasingly complex situations and have become particularly significant in the last decade. Formal modeling techniques have often proved to be of limited value in addressing such situations simply because of the variation in, and the complexity of, potentially important relationships and the degree of understanding that is required initially to develop realistic models. In essence what has occurred is the ability to use less formal modeling approaches through farmer-participatory techniques that empower farmers to drive the modeling process and use farmers' minds as computers. This empowerment has been greatly helped as a result of the evolution of techniques for improving/systematizing collegial, interactive, and meaningful dialogue between farmers and other developmental actors.[6]

Before looking at the four phases I briefly look at the role of farm management that was the precursor to this evolutionary process. I do this because many involved in the early days of the farming systems approach were agricultural economists trained in the neoclassical tradition. Unfortunately in those days many of us had little appreciation of what other social scientists (i.e., sociologists and anthropologists) had to offer. Fortunately our early experiences in the field helped educate us in this regard!

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4 Because nongovernmental organizations (NGO's) and the private sector are increasingly shouldering some of the functions formerly provided by governmental agencies they also are becoming significant developmental actors.

5 In doing I draw heavily on a book chapter Peter Matlon and I had published a couple of years ago [Norman and Matlon, 2000]. A much more comprehensive history of FSR is the book sponsored by IFSA and edited by Mike Collinson which was published a couple of years ago [Collinson, 2000].

6 I don't wish to imply that more formal modelling techniques have no value. Indeed, considerable potential may well exist for improving the relevance/accuracy of formal models as a result of information arising out of informal modeling activities. There is of course a huge literature on what I have chosen to call informal modelling techniques. These initially were rapid rural appraisal (RRA) methods, which have been available for some time [Khon Kaen University, 1987] which more recently have been supplemented/complemented with participatory rural appraisal (PRA) techniques [Pretty et al., 1995; Program for International Development, 1994].

1960'S TO EARLY 1970'S – FARM MANAGEMENT

The farm management approach of the early 1900s was in many ways analogous to what the farming systems approach had become in the latter part of the same century. The farm management of the early 1990s was multidisciplinary and holistic whereas by the middle of the century it, at least in the US, it had become narrower and more reductionist in perspective and increasingly focused on production economics. Emphasis was on normative and prescriptive issues through application of techniques such as budgeting, linear programming, and other tools for applied decision analysis [Johnson, 1981]. Thus agricultural economists armed with these analytical tools and with a strictly neoclassical orientation dominated the farm management-type studies undertaken in the low-income countries during the 1960s. Although useful studies using a more positivist orientation were conducted by sociologists and anthropologists, many of whom predated the work of the agricultural economists, they did not have a major influence on the initial development of the farming systems approach, at least in anglophone countries. They appeared to have had somewhat more influence in francophone countries.

Many of us agricultural economists, associated with development/government organizations, academic institutions, and/or occasionally agricultural research institutions working independently, and spent the 1960s using formal, structured, cost-route, farm-management-type sample survey techniques, to describe farm-level resource allocation patterns and productivity among resource-limited farmers in Asia, Latin America, and Africa.

These studies produced a great deal of quantitative information describing cropping systems (and to a lesser extent farming systems) and their major socio-economic production constraints. They also described how households allocated their resources, and provided estimates of factor returns. Such studies were particularly common in Africa and Asia [e.g., Collinson 1972; Walker and Ryan, 1990; Spencer, Byerlee and Franzel, 1976; Stevens,1977; IRRI, 1979], but less common in Latin America, where economists generally had greater preoccupation with institutional or policy-related issues. These studies showed overwhelmingly that limited-resource farmers have an intimate understanding of their spatially variable and temporally risky production environments within which complex (i.e., combining crop, livestock, and off-farm enterprises) but fundamentally sound and sustainable farming systems had evolved over time. Given these very positive findings about the rationality of limited-resource farmers and the farming systems they practiced, the focus of questions soon shifted to why formally recommended technologies were adopted so rarely [Matlon, 1987].

Thus many agricultural economists, particularly those associated with research stations in Africa, Asia, and Latin America, began to evaluate recommended technologies (i.e., usually packages and typically crop-oriented). Prior the mid-1960s, very few station-based experiments were subjected to any economic analysis, and therefore it was not surprising that the conclusion that often emerged was that many existing recommendations were poorly designed or irrelevant, especially when criteria relevant to farmers were applied. In addition three other significant insights emerged:

- Contrary to expectations of many, farmers were found to be natural experimenters [Biggs and Clay, 1981], using informal methods and consequently it was wrong to conclude they were conservative and averse to change.
- Farmers' production environments were found to be much more heterogeneous than had been thought, and consequently there was a need to develop technological components that could be adjusted easily and combined variously to better respond to location-specific needs, rather than relying on a few technological packages (i.e., the one size fits all syndrome!).
- And although the recommended technological packages were sometimes compatible with the biophysical environments within which farmers operated, farmers were often not able to adopt them because of their incompatibility with the socioeconomic environment within which they operated [Norman et al., 1982].

Questions started arising as to whether the current process for developing and evaluating technologies was relevant for resource-poor farmers operating in less favorable and highly variable environments. It also became apparent that standard conventional economic criteria didn't ensure identification of a relevant technology (e.g., farmers and their households had goals other than profit maximisation, there were usually multiple market failures for capital, labor, land, and information, and risk and uncertainty were significant issues). As a result many of us came to the conclusion that:

- The neoclassical economic paradigm was ineffective in dealing effectively with all the issues relating to small-scale farmers.
- The approach was also too static and deterministic in its orientation rather than recognizing that farmers operate in a dynamic and often uncertain environment.
- The approach of extracting data from farmers (i.e., treating them as objects) and analyzing it independently was much inferior to an approach that recognized the benefits of synergism as a result of interaction and active participation on the part of farmers themselves.
- The approach was flawed in its *ex post* orientation of focusing on evaluating available technologies, rather than using one that encouraged an *ex ante* involvement of farmers in the technology design and development process itself.

As a result many argued for that the conventional research paradigm needed to be modified drastically and replaced by one that would involve farmers as stakeholders from the beginning of the technology design process and that would use an interdisciplinary approach. Thus momentum developed for the evolution of a new approach based on changing from a "top-down" ("supply-driven") approach to farmers, to one characterized as being "bottom-up" ("demand-driven") from farmers.

LATE 1970S TO EARLY 1980S – EARLY FARMING SYSTEMS APPROACHES

Given what was discussed in the preceding section it is not surprising that the newly christened FSR activities were focused primarily on technology development objectives [Gilbert et al., 1980]. In the anglophone countries, several of the international agricultural research institutes (IARCs) (i.e., especially IRRI and CIMMYT) associated with the Consultative Group on International Agricultural Research (CGIAR) played important roles in the early methodological development and popularisation of FSR. At the same time FSR was introduced, with donor support, in many nationally sponsored agricultural research institutes in low-income countries.

The FSR approach that evolved was based on the notion that: one had to begin with understanding the problems of farmers from the perspectives of farmers; and that solutions had to be based on a proper understanding of their objectives and their environments, including both biophysical and socioeconomic components. Also a central tenet of the new approach was that not only did farmers have a right to be involved in the technology development and evaluation process, but that their inputs were essential. Other significant features were its holistic perspective, the fact that scientists involved in the process should represent both technical and social scientists, and that the process was by nature iterative. Consequently, some of the characteristics of the early farm-management approach started to reappear, leading Johnson to observe, in commenting on the new FSR methods, "there has been much reinventing of the wheel in developmental thinking" [1981: p. 2-3].

Although there was a commitment in principle to include a broader set of farmer-based criteria, in its earliest days FSR continued to focus on how yields of particular crops could be increased. However, even though the new on-farm research approach did involve the inclusion of socioeconomic elements, and hence had a farming systems perspective, it was done generally with a predetermined focus that targeted the productivity of a particular commodity (Figure 1). Thus, this approach involved looking at one part of an enterprise or one specific enterprise and identifying improvements within that focus that were compatible with the whole farming system. For example, CIMMYT and IRRI worked on maize-, wheat-, and rice-based systems, which were compatible with their crop mandates. Undoubtedly they had a favorable impact in introducing more of a systems perspective to the influential commodity-based research programs that had a strong reductionist orientation. They believed that the predetermined focus approach was directly relevant to farming systems dominated by one crop, because improving the productivity of that enterprise would have the greatest impact on the productivity of the overall farming system. These two IARCs, in particular, played influential roles through networks and training programs in Africa and Asia, thereby exposing scientists to the principles of the farming systems approach.

Although the IARCs undoubtedly played an important role in introducing and nurturing the farming systems perspective within national agricultural research systems (NARS), simultaneous independent efforts occurred in developing and promoting the approach, usually supported by donor funds. Notable examples were ICTA (Guatemala), Changmai (Thailand), Unite Experimentales, ISRA (Senegal), and the Institute of Agricultural Research, Ahmadu Bello University, Northern Nigeria. Because of the multi-commodity mandates of most NARSs, the farming systems efforts evolved quickly towards a more holistic orientation (i.e., what is labelled farming systems with a whole farm focus in Figure 1). This approach enabled focusing on constraints in any enterprise depending on farmers' articulated needs. This evolution was further stimulated by two other factors, specifically:

- A desire to encourage greater participation by farmers through addressing their specific needs rather than simply trying to "fit" technologies to specific enterprises that had been preselected by researchers/mandates.
- The trend towards establishing separate area-based farming system teams in contrast to an on-farm testing component associated with each station-based commodity team.

The dominant disciplines in the early days of the farming systems approach were cropping systems agronomy and agricultural economics and the methodologies reflected this discipline mix. The trend away from treating farmers as "objects" to treating them as "people", with whom useful interactive dialogue could be established, was helped greatly by increasing reliance on informal surveys or rapid rural appraisal (RRA) techniques. The results of these were sometimes verified by limited-visit formal surveys. The results were helpful in designing on-farm trials that were either managed by researchers or farmers -- but usually executed by the latter -- and were validated by conventional statistical techniques. Trials superimposed as separate plots on farmers' operational fields also became commonplace.

Three very positive results from these early experiences with the farming systems approach:

- Technical scientists were increasingly sensitised to the complexity and variability of farmers' production environments (i.e., consisting of both physical and socioeconomic components) thereby helping reorient technology generation towards addressing needs of different types of farmers and emphasizing more flexible technological components rather than simply blanket-type package technologies.
- The approach provided an opportunity for technical and social scientists to cooperate in the diagnosis of farmers' situations and in the design, testing, and evaluation of new technologies, thus helping those concerned to better understand better the disciplinary perspectives and tools of other specialties.
- Results also demonstrated the importance of complementary policy/support systems (e.g., input distribution systems and product markets) in determining the appropriateness of new technologies.[7]

However, a number of limitations or weaknesses became increasingly apparent. Five particularly significant weaknesses were:

- Farmers' participation was still limited largely to roles assigned by researchers and methodologies for obtaining and systematizing farmers' knowledge and for analyzing the results of on-farm experiments were also poorly developed, often resulting in scepticism about how valid were researchers' interpretation of information obtained from farmers.
- Although the complexities of linkages between farm and household in influencing decision making and flows of resources and benefits were increasingly recognized, methodologies for incorporating such considerations into technology design and evaluation were inadequate and too often purely subjective and *ad hoc* in nature.
- Although some linkages had been developed between the different disciplines (i.e., mainly agronomy and agricultural economics) there was still a lot of room for improvement. The application of the farming systems approach to livestock enterprises was generally particularly weak.

[7] In a sense it provided justification for closer linkages with policy and planning units, although documented success has been limited to date.

- The most commonly used methodologies for data collection and analysis generally were based on the assumption of a monolithic household that could be described by a single objective function and with the household head at the center of the information nexus, in spite of increasing evidence to the contrary (e.g., multiple decision makers, differentiation in terms of distribution of benefits).
- Factors relating to the policy/support system were treated as parameters within which the search for improved technologies took place. This was partly because the mandates of the technology-oriented institutions in which most farming-systems-related work was – and for that matter still is -- based did not include objectives of influencing the policy context and support systems. As a result this severely constrained the types of technologies that could be developed/evaluated.

Fortunately, there was increasing recognition of the above limitations as the decade of the 1980s progressed. The changes that occurred during the decade were supported by an increasing acceptance of a new developmental paradigm, which Korten [1980] characterizes as a "learning process" (i.e. people centered) approach to the earlier "blueprint" (i.e. technology) approach.

LATE 1980S AND EARLY 1990S – NEW DIRECTIONS IN THE FARMING SYSTEMS APPROACH

During the mid to late 1980s, some significant methodological and institutional innovations were introduced in the implementation of the farming systems approach with a whole farm focus.

Three of the methodological innovations were as follows:

- The development of participatory rural appraisal (PRA) techniques provided a way of responding to three concerns namely: how farmers interpreted their production situations; how this influenced the way they articulated their constraints and needs to researchers; and the desire for farmers to contribute more directly and creatively to the design and evaluation of new technologies. Basically, PRA techniques improved the potential usefulness of farmers' participation not only from the farmers' but also from the researchers' perspective by improving systematization of farmers' knowledge and opinions. Thus researchers could move from working relationships with farmers that were contractual or at best consultative to those that were more consultative and collaborative [Biggs, 1989].
- Techniques for examining intrahousehold relationships also evolved and as a result increased sensitivity to gender issues. This helped dispel the notion that the farming household was a single decision making unit in which all persons benefited equally from the fruits of technological change. Thanks to the commitment of Feldstein, Poats, Jiggins, Flora and many others methodologies for incorporating gender-related issues began to be mainstreamed into FSR-related activities starting in about the mid 1980s.
- Significant progress also was made in developing more appropriate methods to analyze the results of on-farm research and make recommendations based on them. Two approaches that deserve special mention are: adaptability (formerly, modified stability) analysis which has proved to be a particularly valuable statistical tool for analyzing results of on-farm trials, particularly those that involve farmer implementation, or both farmer management and implementation [Hildebrand and Russell, 1996]; and PRA techniques – especially matrix ranking and scoring -- which have enabled farmers' evaluative criteria to be systematically taken into account not only in designing on-farm trials but also in evaluating their results.

As a result of these methodological innovations, the potential usefulness of farmer participation in all phases of the research process, from problem identification to technology design, development, and evaluation, has been improved. However, there have also often been institutional changes to encourage more collaborative and collegial relationships between farmers and researchers. Four examples of how new institutional arrangements have been used to promote such relationships are the following:

- Farmer groups (both formal and informal) have increasingly been used to help empower farmers and improve the efficiency of the research/development process by providing a focal point (hence potentially improving the multiplier effect) for interaction with farmers [Heinrich, 1993] and by facilitating farmer-to-farmer interaction. Given the right conditions, such groups have been proven to be very useful in influencing the research agenda and in evaluating technologies (e.g., in Botswana, Tanzania, Mali, Zambia).

- Another less widely used, but potentially even more powerful, way of empowering farmers -- thereby facilitating the development of collaborative/collegial working relationships -- is to involve farmers groups in the decision to allocate research funds, thereby ensuring that the agricultural research agenda is focused more tightly on farmers' real needs. Ashby of CIAT has been one of the pioneers of this approach through the formation of CIALS (Comites de Investigacion Agropecuaria Local) in Colombia [Ashby et al., 1995]. Somewhat analogous approaches are also being tried in some West African countries (e.g., Mali, Senegal).
- Until relatively recently, the conventional wisdom was that farmers' participation in the technology development process should be confined to the adaptive end of the research spectrum but thanks to the pioneering efforts of Sperling and colleagues [Sperling, 1991] working with beans in Rwanda, farmers have been found to be able to make uniquely valuable contributions toward the development of improved varieties. As a result, participatory plant breeding activities have become increasingly popular in a growing number of IARCs (e.g., beans in CIAT, maize in CIMMYT, pearl millet in ICRISAT, barley in ICARDA, and cassava in CIMMYT) as well as in a few NARSs [Witcombe et al, 1996].
- The number of agricultural development actors has expanded in recent years from farmers and public sector agencies to include private sector profit-oriented entities as well as NGOs. The importance of interactive linkages between the developmental stakeholders if relevant technologies were to be designed, disseminated, and adopted, was recognized in the early days of FSR. Thus the establishment of committees at the regional/district level consisting of representatives of the different stakeholders, often including farmer representation, for information exchange, enhanced coordination, and design of collaborative initiatives has become more commonplace. Decentralization policies in terms of governance and in some countries local approval of technological recommendations (i.e., thus helping ensure that new technologies are more likely to address the needs of specific farmers) have also helped this process.

Consequently, major improvements have occurred in the application of farming systems with a whole-farm focus from the mid-1980s until the present time. Also, the range of social (e.g., anthropological, sociological) and technical (e.g., pest-, disease-, livestock-related) disciplines associated with the application of the farming systems approach has broadened, and farmers and their households have increasingly played more influential roles in all aspects of the technological research process.

Other major changes have involved developing technological options rather than standardized packages for farmers and increased transparency in providing information on the conditions in which technologies are most likely to fit and perform best (i.e. targeting information) and suggested fallback strategies if they are not applied in the optimal manner (i.e. conditional information) [Byerlee, 1986].

Most current FSR efforts of NARS fall within the whole-farm focus phase of the farming systems evolutionary ladder, although the degree to which the methodological and institutional issues discussed in this section are applied varies greatly. However, another major limitation that became increasingly apparent towards the end of the 1980s related to concerns about ecological sustainability and environmental degradation. Farmers often appreciate that some of their agricultural practices may contribute to environmental degradation, but short-term survival considerations can lead them to pursue strategies that ensure short-run food supplies but degrade the environment and reduce longer run production potential (e.g., resource-poor households being forced to cultivate marginal soils to meet their subsistence needs or to intensify cropping systems without the means to purchase the inputs necessary for soil fertility maintenance). However, evidence is also increasing that higher income farmers practicing high-input cropping also cause significant environmental damage (e.g., decreasing productivity in the intensive rice-wheat systems of South Asia).

Although researchers often perceive or foresee ecological degradation to be a problem, farmers for reasons just given, may not mention such concerns, unless they threaten immediate survival [Fujisaka, 1989]. Thus, such concerns may not be addressed adequately in FSR, as it was originally conceptualized. Because felt needs articulated by farmers are likely to be strongly biased towards short-run productivity, researchers and development practitioners are increasingly concerned about possible conflict between strategies designed to improve short-run productivity and those aimed at ensuring long-run ecological sustainability. As a response to this, the principles of the farming systems approach and RRA/PRA have increasingly addressed ecological sustainability -- hence the term farming systems with a natural resource systems focus.

Incorporating the farming systems approach into natural resource-related issues has taken two major directions:

- One has involved development and implementation of methodologies to work with farmers to assess bioresource (nutrient) trends and flows at the farm-household level. The idea is to determine biomass trends over time and to help identify, with the farmer, vulnerable parts of the farming system for which modified strategies are needed to promote ecological sustainability. Many of these techniques have their origin in RRA/PRA. Lightfoot and others at ICLARM developed the principles for the approach, which involved integrating aquaculture and agriculture [Lightfoot, Bottrall et al., 1991]. A somewhat analogous approach has been developed by Defoer and colleagues in Africa [Defoer et al., 2000], also involving extensive interaction with farmers to derive bioresource flows on their farms and to identify strategies for reversing any trends towards ecological degradation. These approaches help promote ecologies problems from a foreseen problem to a felt problem in the eyes of the farmers and depend heavily on farmer empowerment and on interactive collaborative/collegial relationships with researchers and development practitioners. The solutions often are farm-specific and involve changes in practices, and, as such, implementation is primarily the responsibility of farmers and their households. Hence, farmers need to buy into adjustments via the participatory identification and design stages.
- The other is ecoregional research, which has been undertaken by some IARCs in collaboration with national research and development institutions. The goal has been to mobilize and focus CGIAR and national funding on natural resource management research with the twin objectives of improved productivity and environmental conservation. Teams of international and national scientists conduct collaborative research targeted at priority regional problems, the aim being to achieve critical mass and economies of scale in the conduct of strategic and applied research, closely linked to adaptive research to address location-specific conditions. The approach involves, in a collaborative operational mode, all the stakeholders involved in the agricultural development process.

There are at least three major challenges when implementing farming systems with a natural resource focus. These are: that large investments are required to address complex processes that are manifested differently across locations; a long time frame needed to improve ecological sustainability and assess progress; and finally, because of the precarious existence of many farmers and their households, ecological sustainability initiatives are likely to be attractive only if they simultaneously improve short-run welfare. [8]

CURRENTLY – A SUSTAINABLE LIVELIHOOD FOCUS

I intend to spend little time on discussing the sustainable livelihood approach since I suspect this will be a topic covered by panel members as they discuss the future.

As I have tried to show, during the 1970s and 1980s, the scope of FSR was broadened systematically to encompass a wider set of issues. That is, the number of variables included within the analytical and prescriptive domain was increased with each new development. The sustainable livelihoods (SL) can be viewed as the end product (i.e., final phase or phase four) of that process.

Although many SL components are similar to earlier farming systems approaches, there are several distinct features. For example:

- Livelihoods are not just jobs but rather comprise a situationally determined complex of activities, asset sets, entitlements, and social relationships that are managed by households to assure their minimum basic needs over time. Because these vary across households in different socio-economic strata within the community, the livelihood strategies of different households also vary. The SL

[8] Unfortunately, conservation/ecological sustainability initiatives still are sometimes separated from those targeting short-run productivity, which has given rise to contradictory policy frameworks.

approach usually places greatest emphasis on the most vulnerable households that are in or near poverty and experiencing either chronic or temporary food insecurity.

- The SL approach places equal emphasis on enhancing efficiency through improved productivity, achieving greater social equity through poverty alleviation, and protecting and enhancing resource base productivity. Thus the SL approach requires a combination of analytical methods including conventional FSR, political economics, anthropology, and environmental science. Generally, these are applied through interdisciplinary teams working in close partnership with local communities.
- The SL approach explicitly links technical change at the household level with complementary changes at the meso- and macro-levels.

Time and space does not permit a detailed discussion of the SL methodology[9] but the aim is to empower households and communities by strengthening their abilities to combine indigenous and modern knowledge, analyze situations, define problems, identify opportunities, conduct experiments, and formulate plans of action. A distinctive feature of the SL approach is the emphasis placed on designing interventions that simultaneously improve current and future productivity, reduce poverty, and protect the environment, without weakening and preferably strengthening the coping and adaptive strategies of the most vulnerable groups in the community. Successful implementation requires major changes in the roles traditionally played by researchers and farmers. Chambers [1991], for example, suggests that outside professionals can help catalyze farmers' empowerment by acting as conveners of farmers' meetings; facilitating exchange of experiences among farmers; and supplying farmers with new technical options and new methodologies to elicit, systematize, and utilize traditional knowledge to solve new problems.

Obviously new production technologies should improve short-term productivity, fit the objectives and resource constraints of poor households, and protect the long-term productivity of the resource base. However, these are not new ideas but what the SL approach does add is the notion that improved technologies should be consistent with and, if possible, reinforce the coping and adaptive mechanisms of resource-poor farmers. Using this idea at least three properties of new technologies that would satisfy this are:

- The notion of flexibility meaning that new technologies should, wherever possible, increase farmers' flexibility to adapt their production and broader livelihood systems to stochastic shocks and to the constantly changing economic environment [Chambers, 1991].
- Emphasis needing to be placed on technologies that reduce risk (e.g., new more resistant/tolerant crop varieties and agronomic practices that reduce the impact of biotic and abiotic stresses, technologies that promote enterprise diversification).
- Finally, new technologies should complement, and not conflict with, the complex livelihood systems of poor households (e.g., if technologies require changes in the demand for labor, such changes may increase returns to labor for the poor in own-farm, wage labor, or off-farm activities, may be neutral, or may compete with labor requirements in their current set of enterprises).

Although it is obviously elegant and holistic, the application of SL to date is limited. There are a number of important challenges for wide application. A particular problem is the problem of up-scaling: because livelihood systems and their associated coping/adaptive strategies vary greatly across sites, and thus the results of SL field work usually are very location specific; and the full application of the SL concept requires well trained and experienced interdisciplinary teams that are skilled in participatory methods and that can work together over extended periods.

CONCLUDING REMARKS

There is every reason to believe that the principles embodied in the farming systems approach -- if not the name itself – and that researchers and developmental specialists, will continue to play an important role in helping the disadvantaged to identify and implement ways to improve their livelihoods. However, making the approach truly effective and widely adopted involves many challenges. The two major challenges are: the need for greater involvement and empowerment of farmers in the search for improvements; and the broader strategies needed to implement those

9 A brief summary is given in Norman and Matlon [2000].

improvements. The first implies a higher degree of locational and farmers' specificity, thereby possibly decreasing the potential multiplier effects of developmental efforts. The second implies the need for a new form of partnership between the different developmental stakeholders and institutions, and for greater liberalization of political structures and processes. Given the generally "top-down", vertical, and highly compartmentalized orientation of most development institutions today, this would seem to call for new institutional structures and processes that facilitate horizontal and more collegial interactive linkages among actors, but with empowered farmers at the center.

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FIGURE 1: PROGRESSION IN FARMING SYSTEMS THINKING