POVERTY ALLEVIATION AND FARMING SYSTEMS IN AFRICA

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ABSTRACT

Enhancing food security and poverty alleviation have been a central preoccupation for mankind especially in Sub-Saharan Africa where hunger persists and has been increasing at an alarming rate in the recent years. Structural adjustment programmes have been implemented in many countries in the region but whilst these programmes have conferred macroeconomic stability on many sectors, farmers still face declining terms of trade and poor access to agricultural inputs such as improved seed and agro-chemicals. At the same time, research efforts in the past 30 years have made in-loads to technological development that have been highly successful in boosting productivity and alleviating poverty. However, there is now recognition that the impact of these agricultural advances have been skewed benefiting mainly the resource endowed producers and often having negative effects that undermine the natural resource base, that poor resource communities and households critically depend on, to meet a wide range of needs.

Developmental strategies that recognise the different community needs, natural resource endowment levels, and household capacity in accessing support services and other facilities are likely to be more effective in enhancing agricultural productivity while addressing household food insecurity and poverty concerns in Sub-Saharan Africa. A study conducted in the sub-region identified 15 farming systems delineated according to the main characteristics and features that can be used to infer to poverty alleviation opportunities. The methodology used combined expert judgement and remote sensing data. Key trends influencing farming systems potential performance were examined and strategic priorities aimed at enhancing productivity in terms of policy, markets, information, technology noted. The relative importance of farming systems research and extension (FSR-E) were examined and the implications for policy and future challenges in FSR-E discussed.

INTRODUCTION

Increasing population pressure on agricultural resources, with the global population recently having passed the 6 billion-mark places a heavy burden on rural households, to generate additional food and income. This situation is made worse by the fact that, the natural resource base is being steadily degraded and it potential depleted, resulting in continuing poverty at an estimated 1.2 billion people living in absolute poverty.

Hunger and poverty in Sub-Saharan Africa is rampant, with 19 of the 25 poorest countries in the world being in the sub-region, despite the abundance of natural resources. Per capita food production in SADC countries has declined during the past fifteen years in 11 of the 14 member countries and food imports have almost doubled (FAO 1999). Rural poverty still accounts for 90 percent of the total poverty and roughly 80 percent of the poor still depend on agriculture or farm labour for their main source of livelihood.[2]

The international development goals set by the World Food Summit in 1996 (FAO 1996) called for achieving food security for all by reducing hunger, with an immediate goal to half the population of 800 million under-nourished by the year 2015[3]. Information assembled to date, indicates that that the necessary average annual reduction rate (of the under nourished) will not be achieved. For instance the

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[2] Poverty has many faces and many indicators; however, for international comparison purposes a consumption poverty line equivalent to US $ 1 per day is often assumed.

[3] The commitment referred to the total of under-nourished worldwide.

average GDP per capita in constant prices was lower in the 90s than in the 70s.[4] Available projections of the anticipated under-nourishment reduction rate (of 8 million people per annum) indicate persistent high levels of hunger in 2030, with sub-Sahara Africa still having the highest percent of the under-nourished. (See FAO projections in Table 1).

Table 1: Trends in Number of Under-nourished

Year	**Under-nourished Population**			
	Developing Countries		Sub-Saharan Africa	
	No (Millions)	(%)	No (Millions)	(%)
1969/70	959	37	88	34
1995/97	790	18	180	33
2015	576	10	184	22
2030	401	6	165	15

Source: Agriculture Towards 2015/2030: An Interim Report, FAO 2000.

Related to the concerns of food insecurity is the fact that poverty has also been increasing. It is estimated that 236 million people or nearly two-thirds of the agricultural population of 384 million live in extreme poverty. There is still an urban bias in development programmes, agriculture is over-taxed and the supply of rural public goods is lower than other regions while transaction costs remain high. Table 2 shows the contrast between urban and rural poverty levels for selected countries.

Table 2: Examples of Rural vs Urban Poverty

Country	Population below national poverty line (%)	
	Rural	Urban
Ghana	34.3	26.7
Kenya	46.4	29.3
Nigeria	49.5	31.7
Madagascar	77.0	47.0

Source: World Development Indicators, 2000. Table 2.7, World Bank

Agriculture is the key to development in Africa, accounting for 20 percent[5] of the region's GDP. Sixty seven percent of the total labour force is employed in the agricultural sector. Overall agriculture plays many roles in national development, including:

- Contributes to household and national food security;
- Provides raw materials and generates export earnings;
- Principals source of livelihoods for rural communities especially the poor. (i.e. two thirds or more of the population depend on agriculture);

[4] World Bank 2000b, Can Africa Claim the 21st Century?
[5] Calculated on the basis of totals published n World Bank, World Development Report 2000 (for countries with data available).

- Influences the management of natural resources including land, forest and genetic biodiversity
- Generates rural incomes and creates employment.

Nevertheless, policies, economic and institutional environments have not created an enabling environment nor have they provided incentives for enhanced agricultural production especially a broad-based inclusive growth that benefits the poor. The performance of past investments in agricultural research and extension has been disappointing while terms of trade have been declining. Moreover, poor governance, escalating civil strife, degenerating rule of law, pervasive gender inequality, low literacy rates and HIV/AIDS pandemic are all major factors that influence development in the sub-region.

Development strategies to alleviate poverty and enhance agricultural production not only require an appreciation of the macro-economic trends but also need an understanding of the community setting and their socio-economic environment including the micro socio-economic factors within which farm production decision are made. Farming systems approach provides the mechanisms through which all the stakeholders including; rural communities, farmers, development agencies such as governments, NGOs and the private sector can forge partnerships through which poverty alleviation can be addressed. Farming systems research and extension approach provides the venue through which farmers/community needs and capacity can be identified; the differences between farmers in terms of their production objectives and resource endowment; capacity to take advantage of technological advances; and access to support facilities including markets, farm inputs and extension services can be identified. In general, FSR-E:

- Provides mechanism for forging partnerships between farmers, local communities, development agencies in research and extension as well as service providers including governments, NGOs, and private firms;
- Provide methodologies through which local communities can be integrated into the development process;
- Facilitates establishment and strengthening of structures through which poverty issues can be addressed especially pertaining to the rural poor;
- Brings attention to the different farmers/community needs, goals, resources and capacities as well as access to support services.

The role of farming systems approach and its applicability to address poverty alleviation can be demonstrated using a case study of land use systems in sub-Saharan Africa.

Major Farming Systems in Sub-Saharan Africa

According to FAO-UNEP-ISSS-ISRIC (1995), categories of broad land use systems that can be distinguished can be summarised as:

- Animal production: with main subdivision on extensive and intensive grazing and further subdivision into small-scale grazing and ranching.
- Crop agriculture: with subdivision into annual and perennial tree/shrub cropping, with further subdivision into rain-fed and irrigated farming, large scale vs. small scale production as well as subsistence and commercial farming.
- Forestry: with subdivision in natural/woodland forestry and plantation forestry as well as communal forestry.
- Fisheries: based on natural waters or man made/managed systems such as fishponds.
- Extensive natural resource management mainly to conserve fauna and flora: including national parks, game reserves and bio-diversity conservation reserves with or without human management.
- Settlements: including industry, infrastructure, recreational purposes and mining.

In the case of Eastern and Southern Africa sub-region, fifteen broad land use systems can be

identified[6] through the use of combined expert judgement, local information and remote sensing data. The main characteristics of these major farming systems reflecting the principal source of livelihoods and coverage in terms of area and population are shown in Table 3.

Table 3: Farming Systems in Sub-Saharan Africa

Farming System	Principal Livelihoods	Land Area (% of region)	Agric. Population (% of region)
Irrigated	Rice, cotton, vegetables, Rainfed crops, dairy, poultry	1	2
Tree-Crop	Cocoa, coffee, oil palm, rubber, yams, maize, off-farm work	3	6
Forest Based	Cassava, maize, beans, cocoyams	11	7
Rice-Tree Crop	Rice, banana, coffee, maize, cassava, legumes, livestock, off-farm work	1	2
Highland Perennial	Banana, plantain, enset, coffee, cassava, sweet potato, beans, cereals, livestock, poultry, off-farm work	1	8
Highland Temperate Mixed	Wheat, barley, tef, peas, lentils, broad beans, rape, potatoes, sheep, goats, livestock, poultry, off-farm work	2	7
Root Crop	Yams, cassava, legumes, off-farm income	12	12
Cereal-Root Crop Mixed	Maize, sorghum, millet, cassava, yams, legumes, cattle	13	15
Maize Mixed	Maize, tobacco, cotton, cattle, goats, poultry, remittances	10	16
Large Commercial and Smallholder	Maize, pulses, sunflower, cattle, sheep, goats, remittances	5	5
Agro-Pastoral Millet/Sorghum	Sorghum, pearl millet, pulses, sesame, cattle, sheep, goats, poultry, remittances	8	9
Pastoral	Cattle, camels, sheep, goats, remittances	14	7
Sparse Agriculture (arid)	Irrigated maize, vegetables, date palms, cattle, off-farm work	18	2
Coastal Artisanal Fishing	Marine fish, coconuts, cashew, banana, yams, fruit, goats, poultry, off-farm work	2	3
Urban Based	Fruit, vegetables, dairy, cattle, goats, poultry, off-farm work	Little	little

Source: Carloni (2001), based on FAO data and expert knowledge.

The functions and characteristics of the prevailing farming systems identified in the sub-region can be said to be the outcome of the interplay between bio-physical attributes, farmers' goals, needs and strategies within a given endowment of the resource base and the socio-institutional-economic environment. The systems consist of a complex household production/management processes; comprising a mixture of crops, livestock and tree production subsystems/components. The systems are complex and very diverse and it is not for instance strange to find over 10 different crops in one plot in the Forest Based System compared to the Large Commercial and Smallholder system, which tends to

[6] See Carloni, 2000. In the convention for naming farming systems in this paper, the term "mixed" connotes crop-livestock systems and the term based indicates a dominant enterprise. The process of delineation of farming systems and estimation of data involved a range of sources and substantial input of expert knowledge of agricultural conditions in different parts of the region. The figures provided herein should therefore be considered as provisional estimates, which may be refined in future studies.

feature monocropping crop husbandry.

Each farming system has its own distinctive features that make its functions and performance different. The interaction and relationship with the external environment has a strong influence on their internal management characteristics. For instance the level of farm management in terms of use and application of purchased farm inputs, equipment/machinery as well as marketing activities vary with the Large Commercial and Smallholder system likely to display the high input-high output features. Livestock component is more important in the systems located in arid and semi-arid agro-ecozones. Off farm income through employment or remittances is an important component for a few of the systems.

In defining the systems, emphasis has been placed on the characteristics of the most typical core farm-household system but due to the vast areas covered and the influence of micro-climate, infrastructure network and access to support services; they all show considerable heterogeneity within the system. Thus several subs-systems with substantial variation in terms of the scale of production, the types of enterprises, level of management as they relate to subsistence or cash oriented production and off-farm income components can be found in each broad land use. Some of the systems have similarities especially on the types of crops produced while the boundaries between them are also generally imprecise due to the interpenetrating attributes, giving a gradual transition from one farming system to the next.

The incidence and levels of poverty and food insecurity as well as degradation of the natural resources within these systems is a combination of both the internal and external bio-physical and socio-economic environment which determine their overall production potential and exploitation. For example although the Sparse Agriculture (arid) covers 18% of the land area, it supports only about 2% of the population. In contrast the Maize Mixed System while supporting 16% of the population only occupies 10% of the area. Highland Perennial on the other hand occupies only 1% of the land but supports 8% of the population. It is important to note that only one of the systems has substantive commercial production orientation and that several of the systems have an off-farm work components.

FSRE approach through remote sensing techniques and knowledge of the region as well as secondary documentation of basic data on annual production trends, household profiles, distribution and network coverage of support facilities such as markets and extension services was used in this case to:

- Define the mode of land use, local community capacities and access to natural resources
- Summarise the characteristics of crop production component; i.e.
  - Cropping patterns, the types of crops grown and management levels,
  - Identify the percentage of the land that is arable and area planted with crops;
  - Distinguish land utilisation in the upper and lower watersheds;
  - Establish presence of large-scale commercial farms and irrigation schemes;
- Identify the types of animals kept, relative importance to the household economy and their spatial distribution;
- Give a feel of the production orientation in terms of cash vs. subsistence systems.
- Relate the physical description of the region to it actual production performance and its potential;
- Interaction and access to macro policies and support services;
- Facilitated the assessment of the current performance of the different systems, their current production constraints and possible causes;
- Opportunities and possible areas of intervention;
- Define possible stakeholders;
- Determined potential target beneficiaries

General land use patterns that emerged would seem to indicate that; Tree-Crop, Forest Based, Rice-Tree Crop systems are predominant in the humid lowlands of West and Central Africa. Sub Humid Highlands of Eastern and Central Africa on the other hand feature the Highland Perennial, Highland Temperate Mixed systems which gradually give way to Root Crop, Cereal-Root Crop Mixed, Large Commercial and Smallholder, Maize Mixed system in the sub-humid Plateau of Eastern and Southern Africa. Agro-Pastoral Millet/Sorghum and Pastoral Systems are found in semi -arid areas. Irrigated Based systems and Sparse Agriculture systems are found in isolated spots in sub-humid, semi-arid and arid areas, while Urban Based system is located near large urban centres.

In order to determine what opportunities exist in increasing productivity in such systems one needs to appreciate the potential of the prevailing resources, the current performance levels and the complexity in decision making in terms of resource allocation and the interactions between the various enterprises. For instance maize production in the Sparse Agriculture system is very different in terms of crop husbandry compared to maize production in the Forest-Based system or Maize Mixed system.

Farming systems approach provides the mechanism through which we can attempt to understand the processes and dynamics involved in the decision making on the various components, at the household and community level. For instance by working with communities one can establish the main limiting factors and constraints of the system. For instance, low production in Agro-pastoral Millet-Sorghum based system can be said to be partly due to poor access to inputs e.g. fertiliser, improved seed, credit and/or output markets as well as limiting climatic conditions. Crop production in Highland Perennial Based and the Highland Temperate Mixed Based systems is constrained by poor access to arable land due to high population density and rough terrain in both systems. Both can benefit from improved market through the private sector or by farmers' organisations. Nevertheless the Highland Perennial Based system suffers more from under-developed marketing facilities (except for coffee), while high marketing costs due to low traded volumes is likely to be more limiting in the Highland Temperate Mixed Based system. The most limiting factor for the sparse agriculture based systems is the climate especially low soil moisture.

A review of the farming systems indicates an overall declining performance over time. Some of the broad economic issues that have influenced performance of particular farming systems include:

- Poor access to production resources due to low incomes;
- Limited access to output/input markets and/or underdeveloped markets;
- Poor access to draft power;
- Low production due to poor access to arable land emanating from high population densities or cropping on inherently low fertility/marginal soils;
- Limiting cultural practices;
- Unreliable climatic conditions;
- Lack of enabling policy strategies.

Key trends observed from the review of these farming systems indicate that the natural resource base has increasingly become fragile. Declining production is widespread and continuous cropping without adequate nutrient replenishment has increased since the majority of the farmers can no longer afford fertilisers. Cultivation in non-arable lands and overgrazing as well as clearing of forest lands for crop production have taken their toll in most of the land use systems resulting in soil erosion and degradation of biodiversity. Overgrazing is quite prevalent in the semi-arid and arid zones. The section below highlights broad trends in the external socio-economic environment that has impacted on farming systems and their overall agricultural performance in the recent years.

Key Trends Influencing Farming Systems Environment[7] in Sub-Sahara Africa

The population of Sub-Saharan Africa is projected to increase by 78 percent in the coming three decades. Though AIDS pandemic is expected to have a major dampening on population growth as well as causing severe hardship on agricultural production due to reduced access to skilled and unskilled labour supply, population in the agricultural sector is expected to expand by 30 percent. Urban population, currently at 33 percent is expected to rise to 50 percent of total population by 2030. The Sub-Saharan Africa is unique in that it continues to experience rapid urbanisation during a period of economic contraction.

Arable land in use has expanded from 123 million ha in 1961-63 to 173 million ha (including annually cultivated land and permanent crops) in 1999. This represents a slow annual expansion of 0.73 percent. Though the region has a moderate level of renewable water resources, only 6.5 million ha are currently irrigated. I.e. only 2% of the available water is currently utilised for irrigation compared to 20 percent in the overall group of developing countries.

The region currently has 201 million heads of cattle, 184 million goats and 159 million sheep. Tsetse infestation is a major factor influencing the distribution of livestock between different agro-ecological zones. The tsetse challenge tends to be concentrated in the moist sub-humid and humid lowlands, and in drier areas near game reserves. In spite of this, increasing numbers of cattle can be found in areas which were originally tsetse infested such as the moist sub-humid and dry sub-humid zones. Nevertheless, cattle numbers per household tend to be higher in the drier agro-ecological zones than in the moist areas. The regional livestock numbers grew at 2.4% per annum from 1967 to the present.

The average daily diet (in the 1995-97 period) comprised 2188 kcal/person/day in Sub-Sahara Africa compared to 2626 in developing countries as a whole. It is estimated that 33 percent of the regional population was undernourished at this time, with a higher incidence of under-nourishment found in rural areas than among urban dwellers.

Structural adjustment programmes have been implemented in a many countries in the region and whilst these programmes have conferred some macroeconomic stability, farmers continue to face declining terms of trade and limited access to agricultural inputs such as; improved seed, fertilisers and other agro-chemicals as well as draught power and equipment. Purchased farm inputs have been increasingly unaffordable for many low-income producers especially with market liberalisation and the removal of subsidies. Capital farm investment has also been declining.

Although the absolute value of agricultural exports has risen since 1961, the region's share of world agricultural trade has fallen. The sharpest fall being in Southern Africa, whose share of world agricultural trade in absolute terms fell from 9% in 1961 to 3% in 1998. In proportionate terms however, other sub-regions of Africa have done little better. There has been much more stability in Africa's share of world agricultural imports, which forms a smaller proportion of world trade than do exports, ranging from 0.2% in Central Africa to 1% in West Africa.

In 1998, agriculture accounted for 47 percent of total exports from East Africa, whereas agriculture's share of total exports dropped from over 70 percent in 1961 to only 9-10 percent in 1998, in West and Central Africa as a consequence of the petroleum exports development. Over the same period Southern Africa agricultural exports declined from 59 percent to 14 percent due to the expansion of non-agricultural sectors. Of the sub-region's principal agricultural exports; cocoa accounted for 22% of total agricultural exports in Central Africa and 48 percent in West Africa. The coffee share varied between 12 percent and 25 percent in West Africa and East Africa respectively. Cotton ranged between 5 percent in East Africa and 26 percent in Central Africa. The top exports for Southern Africa, mainly from the Republic of South Africa were sugar, wine and fruits.

[7] Except where indicated, these data are drawn from FAO 2000.

There has been a broad stability in the proportion of agricultural products imported to the region over the past three decades. The range is from around 20 percent in Central Africa, 15 percent in East Africa and West Africa to 8-12 percent in Southern Africa. The main agricultural imports consist of cereals (wheat, rice and maize). Over the past 30 years, these have risen from 5% of total cereal consumption to 14%. In is anticipated that by 2030, the region will need to import an estimated 16% of its total cereal requirements.

The bulk of cereal imports by the region have been on a commercial basis rather than as food aid, except in a few years. For instance, food aid in1995–8, accounted for 17% of the total cereal import whilst in 1975–8 it was 25%. Nonetheless, in 1998 per capita food aid flows were three times as large as food aid flows to Asia and Latin America. However, food aid shipments have recently fallen from 15.1 million tons of cereals in 1992/3 to just 8.8 million tons in 1998/9. In particular, shipments to low-income food-deficit countries in the region declined by 63 percent.

The reduction in government expenditure on extension and agricultural training in many countries, during the past decade has reduced the availability to farmers of technologies and market information. It is expected that existing alternative sources of information will expand and new channels for agricultural information flows emerge. Already, farmer's organisations in a number of countries have stepped up extension and training activities. In addition, the private sector's role in technical and market information provision in connection with commercial crop and livestock activities is expected to expand greatly during the coming three decades.

Broad Themes in Farming Systems Research and Extension Approach

The role FSR-E approach has played in improving our understanding of how the land use systems identified in sub-Saharan Africa function and how their performance can be improved to address poverty alleviation more effectively, can be traced by reviewing farming systems approaches in the subregion. Review of farming systems approach (FSA) indicate that since its first applications in the early 1970s, it has undergone various modifications which have affected its potential role on poverty alleviation strategies in several ways.

The initial focus of farming systems approach (as FSR), lay on the development of relevant and viable technologies for resource-poor farmers, thus setting historical roots that are strongly connected to poverty alleviation through adoption of high potential technologies. Due to changing socio-economic priorities, FSA has expanded its horizon from an on-farm technology testing focus, to address a wider range of issues confronting small holder farmers in relation to agricultural input supply, markets, extension, infrastructure, other support services and policy. Concerns addressed by FSA now also include issues related to sustainable natural resource management and environmental degradation.

From a global perspective, the need for FSA arose from the concern that despite the milestones achieved from technology development and the expectations from the so-called green revolution, small-scale agriculture especially in sub-Sahara Africa continued to lag behind. While researchers, extension and other development agencies focussed on the promotion of technologies that were not necessarily in synergy with the resource base at the community/household. Farmers had to adjust these technological packages to suit their farming conditions. These resulted in development of inappropriate technologies that tended to emphasis increasing commodity productivity by focusing on factors of production rather than available farm resources. Consequently displaying very low adoption rates. Sustainable agricultural production continued to be evasive culminating in high rural food insecurity, poverty and degradation of natural resources.

The recognition that the poverty situation had not improved despite the fact that research in the past 30 years had been somewhat successful in boosting productivity and alleviating poverty in some developing countries called for re-examination of our developmental strategies in Sub-Saharan Africa. There was therefore a driving demand for broadening research and management approaches to

embrace a range of bio-physical and socio-economic variables at the household level that included communities participation in the process.

There is a growing consensus on the effectiveness of FSA in research, extension and other support services with respect to providing the impetus for the development for the complex risky small holder production systems. A system's approach with a participatory perspective has been the signature of FSA to which ancillary themes have been added. The evolving foci of FSA since the early 1970s and its current focus are presented in Table 4.

Table 4: Components and Emphasis of FSR-E from mid-1970s to the Present

	Early1970s	Early 1980s	Early 1990s	Early 2000s
System Level:				
Farmer	***	***	***	***
Household		*	***	***
Community			***	***
Breadth of System Focus:				
Crops	***	***	***	***
Crop-Livestock	*	*	**	***
Crop-Livestock-Trees-Off-farm		*	**	***
Service/Function Focus:				
Research	***	***	***	***
Research + Extension	*	**	***	***
Research + Extn. + Support services		*	***	***
Institutional Focus:				
Public	***	***	**	***
Public + Civil society		*	***	***
Public + Civil society + Private			*	**
Integration of Other Components:				
Natural resource management			**	***
Gender-analysis		*	***	***
ITK			**	***

*Notes: * indicate degree of emphasis. Assessments adapted from Dixon and Anandajayasekeram, 2000*

Although basic FSR-E concepts and principles have remained constant, adjustment of field methods in response to changing circumstances has continued through the years. It is anticipated that continuing emphasis on commercialisation and overriding impacts of globalisation are likely to induce FSR-E to incorporate more micro-economic issues and market analysis in the coming decades.

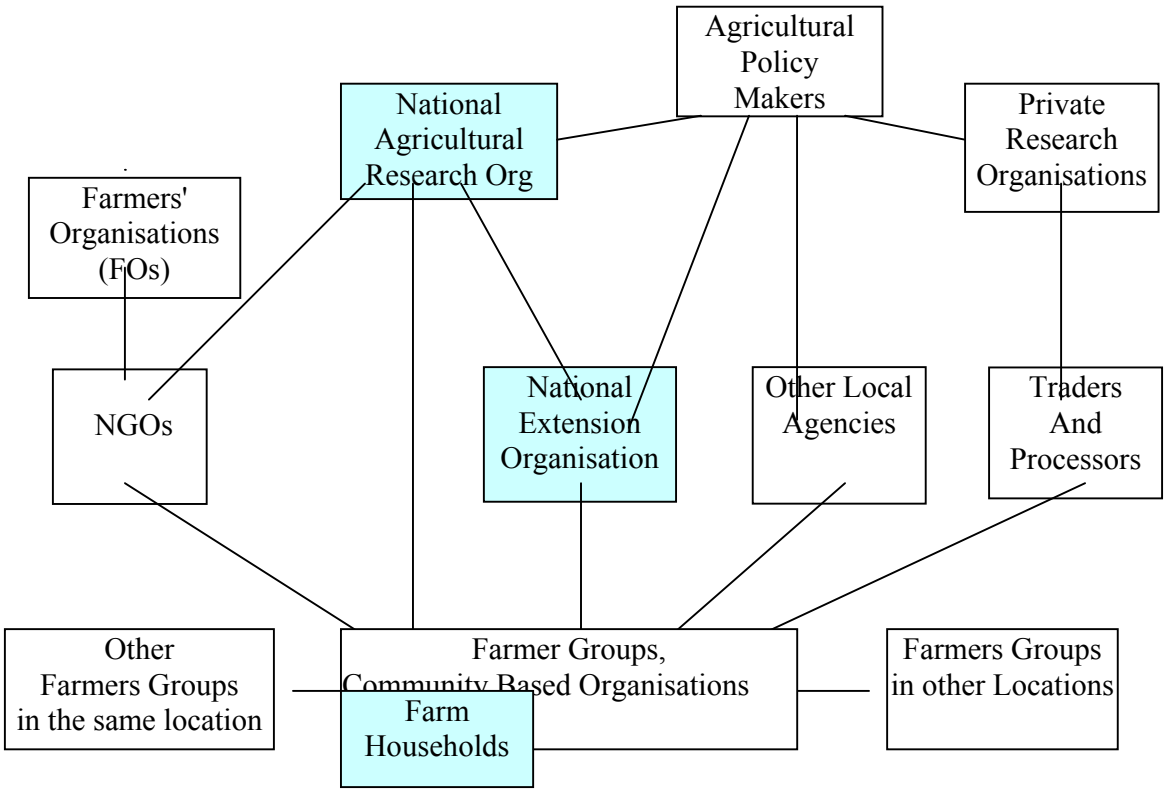
To date the most important inclusion to the FSR-E approach, is the development of participatory methods and tools that ensure community/household contribution in the whole agricultural production-decision making process. Since farming decisions are influenced by a large number of factors, a client oriented technology development focus that incorporates a synthesis of how communities and individual households in allocating production resources has been a milestone in providing researchers and extension, opportunities to identify niches in poverty alleviation.

Several key methodologies which have evolved over time are based on community participation and have been applied in situational analysis/diagnosis and planning; rapid rural appraisal; participatory farm management approaches; participatory extension approaches; participatory learning and action; agricultural knowledge and information systems; participatory communication approaches; farmer field schools; and participatory impact monitoring. Methodological tools including; causal diagrams; watershed/landscape transect walks; natural resource mapping/resource flow diagrams; labour/activity charts and budgets; community-based action plans; Venn diagrams; and matrix ranking have been

developed to facilitate participation of communities in compliment of conventional methods. The application of these methodologies has resulted in a definite shift from a top-down approach to a more client oriented participatory process.

The institutional arrangements and organisational structures also act at important determinants in the application and effectiveness of FSR-E methods, in terms of planning, budgeting and administration, implementation of field activities, co-ordination, monitoring and evaluation. Figure 1 sketches the key stakeholders in a typical rural development programme.

Figure 1: Types of Stakeholders Involved in Agricultural Support Systems



Note: Only principal linkages indicated; shaded boxes represent key actors during the 1980s

Structural adjustment and decentralisation has seen research and provision of extension, training and other support services, especially for export crops shift from the public to the private sector especially co-operatives and farmer organisations (e.g., Kenya and Uganda), as well as private firms (e.g., South Africa and Zimbabwe). Emphasis on cost-effectiveness in field methods, emanating from commercial environment necessitates use of FSA methods, which utilise more farm management/micro-economic tools in their diagnoses and planning.

As FSR-E practitioners progressively have better qualifications and more training in participatory methods, the possibility of selecting field methodologies from a toolkit becomes feasible. Thus a generalised application of FSR-E in a system-wide model though requiring sound quality control mechanisms can be anticipated. By the same token, the next decade should generate new FSA methods that are less dependent on the level of training or experience of the team, i.e., robust methods that can be used by staff with a minimum of training. During the 1980s, external funding was a major direct factor in FSR-E institutionalisation and field methods refinement. Presently, project conditionalities attached to SAPs have a strong influence (Eponou et al. 1999).

Poverty Alleviation and Farming Systems Approaches

What has been Achieved by FSR-E in Addressing Poverty?

The conceptualisation of FSR-E and its application in sub-Saharan Africa has resulted in a definite shift from a top-down approach to a more client oriented participatory process. There is a general acknowledgement and acceptance that sustainable development must be driven by beneficiaries themselves. Thus mechanisms, including group methods and participatory approaches have been put in place in order to facilitate involvement of farmers and rural communities in the development process.

There is also recognition that there is need to set up partnerships and linkages or networking strategies as well as effective communication channels with all the stakeholders. This has been achieved through the institutionalisation of FSR-E resulting in the establishment of various forms of co-ordinating units and joint planning and implementation structures.

FSR-E also broadened the concept of agricultural development. Diagnostic processes including constraints analysis and problem prioritisation often led to the realisation that agricultural production is often impacted by external forces which influence farmers access to purchased farm input, farm equipment and output markets and credit facilities. By integrating rural development and sustainable livelihood concepts, a more comprehensive agricultural development strategy has been developed.

An appreciation that sustainable development much be matched with the natural resource base management is a major outcome of FSR-E. Agricultural development theories, in the 1960s and 70s based on the green revolution assumed that generation of improved technologies would result in sustained and increasing agricultural production. The resultant experience especially in Sub-Saharan Africa has been contrary with declining yield, erosion of bio-diversity and overall natural resource degradation the norm. Development of integrated natural resource management strategies is seen as key to agricultural development especially in fragile eco-systems.

FSR-E approaches also highlighted the need to integrate 'scientific' and 'indigenous' knowledge in technology development and transfer. Involvement of farmers in technology development process ensures that technical and socio-cultural expertise which have been developed by rural communities over the years is incorporated in the generation of appropriate technologies which have higher rates of adoption potential.

Limitations of FSR-E

One question to ask oneself is why successful comprehensive cases of poverty alleviation through FSR-E are so difficult to find when so many people are talking about integrated participatory approaches. Several issues can be noted:

- Research methodologies are still reductionist in nature. An all integrated technological development strategy that meets the needs of the various components of a farming system is still a far cry. In reality it makes practical sense only to integrate those additional components, stakeholders or scales that are essential to solving the problem at hand.

- Farming systems approach should be more concerned with providing information to improve decision-making at the farm level, by providing a basket of options that are resilient in terms of natural resource management especially the reconciliation of conflicting management objectives between various enterprises and community needs. It should therefore provide the foundation for better management skills and technological options as opposed to provision of technological packages.

- Due to the complexity involved in FSA, participatory action research whereby researchers, farmers and extension become partners by engaging in dynamic strategies from assessing the prevailing situation to analysing the effects of their actions should become the main modus operand. The resultant outcome should be the development of practical solutions to problems rather than neutral analysis of static systems. Action research should take place at household level, community/ village or watershed/farming system level. The prevailing institutional arrangements are not necessarily conducive to this concept.

- FSA is best achieved as a learning process whereby the focus is on monitoring changes in the whole system to determine patterns and causes of change in order to determine management interventions. However, it is important to recognise that there are multiple layers of managers and decision-makers as well as different levels of resource endowment and access to support services even within a given farming system.

- Much of the scientific culture, i.e.; training, planning, management, reporting, dissemination, evaluation, measurement, time-frame for funding and impact assessment is not favourable to achieving FSA. Conventional research focuses attention on 'plots' or 'demonstration areas' while extension is based on technological packages. Thus there is usually need to show changes that can be directly and immediately attributed to research and extension. FSA requires a rethink on the full spectrum of components that currently constitute our scientific culture and the assumptions about the capacity of organisations to deal with multi-sectoral, multi-stakeholder and multi-scale issues.

- FSA may be centred on specific technologies that provide options for improved resource management such as the adaptation of an improved crop variety to specific farming conditions. Thus it should be hinged on natural resource management rather than development of a specific set of technologies. The ultimate total integration of the elements of management of the resources available at the farm level may not be achievable, however, an attempt to modify existing research and development efforts to achieve higher levels of integration is desirable.

In its ultimate application, FSA implies a close working relationship between research, extension, management and farmers. Thus field activities should not be planned or designed independently but jointly in a context of innovative systems whereby multiple actors contribute to development of the innovation. This is easier said than done, as the prevailing institutional arrangements in most countries are not suited to participatory approaches. There are therefore limitations in applying these methodologies at wide-scale level.

There is a fundamental issue on whether the marginal costs of adding each additional component or scale into the system have considerable marginal benefits of such additions. This highlights the need for a clear articulation of the problem, the establishment of appropriate research hypotheses and above all, a high probability of tangible benefits within reasonable time frames. Coupled to this is the issue from the perspectives of different stakeholders (disciplines/organisations) involved in FSA on the degree to which integration of different fields can be used in technological development, or in resolving sustainable natural resource management issues.