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THE LOW INPUT FARMING SECTOR IN SUB-SAHARAN AFRICA: LESSONS AND EXPERIENCES

Kojo Spio¹

The small-scale farming sector continues to battle with the daunting task of moving from the "subsistence syndrome" to the "plane of entrepreneurship". This paper provides a review of some of the attributed factors which continue to affect the performance of the sector. Suggestions about ways to improve efficiency and to beautify the landscape of the small-scale farming sector are also made. One of the suggestions that runs through the paper is the need for the various governments of Sub-Saharan Africa to overhaul and review their agricultural policy to make it more relevant to the needs and aspirations of the small-scale farmers who constitute about 60 per cent to 70 per cent of the farming sector.

DIE LAE-INSET BOERDERYSEKTOR IN AFRIKA SUID VAN DIE SAHARA: LESSE EN ONDERVINDINGS

Die kleinskaalse boerderysektor is steeds besig om te worstel met die moeilike taak om van 'n "onderhoudsindroom" na die "vlak van ondernemerskap" te beweeg. Hierdie artikel verskaf 'n oorsig van sommige kenmerkende faktore wat steeds die prestasie van die sektor beïnvloed. Aanbevelings word gedoen oor metodes waardeur doeltreffendheid verhoog, en die landskap van die kleinskaalse boerderysektor verfraai kan word. Een suggestie wat soos 'n draad deur die artikel gaan is die nodigheid vir verskillende regerings in Afrika Suid van die Sahara om hul landboubeleid te wysig en te verstel teneinde dit meer toepaslik te maak met betrekking tot die behoeftes en aspirasies van die kleinskaalse boere wat ongeveer 60 tot 70 persent van die boerderysektor uitmaak.

1. INTRODUCTION

Agriculture is the touchstone of the economy of most countries in the Sub-Saharan Africa; this sector has however performed disappointingly. Agricultural development is lagging behind because of poor and deteriorating performance of crop and livestock production and scant modernization of technology. The result has been an unfavourable relationship between production and population growth, forcing many countries to depend on food imports and aid.

Sub-Saharan Africa seems to stand more clearly each year in the World Bank atlas of indicators. It remains a continent in which per capita food supply continues to decline. Yet, in terms of natural resources:

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“.....Africa has enough land for food self sufficiency. Even with the assumption of low levels of inputs, the combined potential productivity in all 51 countries could feed nearly three times the people in need.The specific results for the continent as a whole, estimate average potential population supporting capacities of 0.39 persons per hectare (pph) with low levels of inputs, 1.51 pph with intermediate inputs and 4.46 pph with high levels of inputs. These potentials are respectively 2.7, 10.5 and 31.7 times higher than the average present population density of 0.14 pph” (Higgins *et al.*, 1981:19).

Small holdings play a very important role in African agriculture, both in terms of their number and numbers of people involved. For example in Mali, 75% of farms are under 5 ha.; in Kenya, 770,000 smallholdings, ranging in size from about 0,5 ha to 10 ha. were recorded in 1970, while the number of large holdings was only 3175. In 1971, 90 percent of the total population of 11,7 million of Kenya lived in rural areas, 70% of whom on smallholdings (Gakou, 1987:46).

The poor but efficient hypothesis has been subjected to a rigorous critique on both methodological and empirical grounds. Small farmers in traditional agriculture remain poor mainly because of limited technical and economic opportunities; they will generally be capable of making rational economic decisions if these constraints are removed (Schultz, 1964). However, these constraints continue to be treated in an unholistic way, enhancing their reoccurrence with time. Some important constraints are discussed and policy options suggested.

2. LAND - ITS AVAILABILITY AND TENURE ARRANGEMENTS

Land can be viewed from two perspectives. In certain African countries, land itself is not a limiting factor of production, but the type of tenure arrangements associated with it can affect land use, for example, Ghana. The availability of land in those countries may be attributed to i) less interference in land issues by the past colonial governments and therefore less distortions have occurred; most of the land is in the hand of the traditional authorities who are prepared to lease some out even to foreigners and ii) most of the farming are done on a small scale, hence the available arable lands are sufficient enough to accommodate most people who are willing to farm. In others, the availability of land is a problem in itself; this problem may not be associated with tenure arrangements. In South Africa and Zimbabwe, skew ownership of land resulted from racial suppression and colonial legacy.

Land tenure is a traditional institution which continues to capture attention and remains to be a the major agenda in developing countries. Its significance

extends beyond peasant production to the basic dimensions of the social system. Land tenure systems can influence the organisation of farms by placing constraints upon the accessibility and exploitation of opportunities on the land, thereby qualifying both time horizon constraints (implied in Estate) and security of the initial access route for people engaged in agriculture (Ofori, 1971). Some development economists (Dorner, 1972; Harrison, 1987) regard indigenous tenure systems as static constraints on agricultural development, providing insufficient tenure security to induce farmers to make necessary land-improving investments. The following features of the land tenure systems have been identified as barriers to agricultural development in Sub-Saharan Africa (La-Anyane, 1979):

- a) Fragmentation and diminution of holdings result in small holdings and consequently reduced access to credit.
- b) Absence of registration and written records leads to time consuming litigation. The lack of adequate measurements, and the chaos of the present registration system create much insecurity and litigation.
- c) The difficulties involved in acquiring new land.
- d) The inability of farmers to make permanent improvements or plant permanent crops on land which is commonly owned or land held by pledge on short term lease.
- e) Rents act as a drag on efforts to improve farm methods because of unequal investments and unfair sharing of returns between landlords and tenants.

However, others like Cohen (1980), regard indigenous tenure arrangements as dynamic arrangement that evolve in response to changes in factor prices. Land tenure is part of the institutional structure of society and since societies are not stagnant, and to the extent that societal structures evolve, so do land tenure systems. According to Migot-Adholla *et al* (1991), there is a spontaneous individualisation of land rights over time, whereby farm households acquire broader and more powerful sets of transfer and exclusion rights over their land as population pressure and agricultural commercialisation proceed. They are of the view that foreign anthropologists and colonial administrators have regarded the African land rights systems inferior to the Western property rights systems. They deny that: a) the indigenous tenure systems assign land rights to the community and that communal control discourages long-term investments in land improvements; and b) land is an integral part of the social system and

legitimate use is determined by birth, affinity, common residence, and social status or some combination of these; transactions are limited to members of the lineage and therefore encumbers the emergence of market transactions in land.

It may therefore not be wrong to suggest prudential intervention by governments in areas that still pose problems to agricultural production. Land tenure reform may be regarded as a necessary but not sufficient condition for agricultural progress. Voluntary acceptance of changes in land tenure by the rural population is a prerequisite for its success (Groenewald, 1993). Governments should not use force to ensure reforms, rather they should create an enabling legal and institutional environment for efficient transactions in land markets. Groenewald (1993) argues that this may open possibilities for a sensible conversion from communal to individual or lease tenures. Flexibility, mobility and efficiency will be enhanced by rendering lease contracts transferable, and thus develop a land market and a financial value to land without necessarily dissolving communal ownership in favour of private freehold.

Critical issues and areas of customary tenures that needs examination may include (Migot-Adholla *et al*, 1994; Ofori, 1971):

- ✦ Security of tenure and duration of tenancies - The three aspects of tenancy, fixity of tenure; fair rent; and fair compensation (often referred to as 3F's) needs to be revisited. Tenants' security can be achieved by making regulations governing the form of tenancy contracts, such as stipulating that they must be in a written form, or making it obligatory to register them. A minimum duration for tenancy should be laid down. Regulation must be put into place to limit the height of the rent or annulling the obligation to pay rent in the case of crop failure.
- ✦ Lack of boundaries and standardised unit of measure - The importance of land records and other relevant information cannot be overemphasised. Absence of these vital information and the inaccuracy of what is available has been cited as the chief sources of land litigations in many African countries. Various instruments and legislation must be put in place to eliminate these distortions.
- ✦ Access to credit and other inputs - Commercial banks have been reluctant to lend to farmers under the customary tenure where ownership titles cannot be given as collateral for loans. Various authors have suggested methods to solve this problem. a) The use of group lending schemes, b) guarantee schemes for farmers, and c) individualising land.

- ↖ Access to land by women - Women's right to property has been a serious problems in developing areas in South Africa and some other African countries, even though women form a greater percentage of farmers. The Government should enact laws to remove any form of discrimination based on sex with regard to property rights as well as addressing the gender imbalances. For example, in Ghana, the recent enactments of intestate succession, marriage and divorce, administration of estate and head of family (accountability laws) may also be said to have been attempt to give recognition to the nuclear family as the basic unit of production, and to protect the interest of wife and children over family land, where the father (husband) dies intestate.
- ↖ Access to land and conservation of natural resources - To ensure sustainable and beneficial reforms, the issue of the environment needs to be addressed.

With regard to the availability of land, the call for land reform is in the right direction. Reforms may remove or eliminate the inefficiency and inequity associated with the dualistic landholding structures, for example in South Africa. Legal system and traditional practices which give ownership and control over land to men should be abolished because the lack of access to land, and lack of collaterals prevent women from having access to credit, a situation which is particularly serious for female-headed households (Meliczek, 1995:23).

The reforms should also achieve the following objectives:

- a) de-emphasise class, race and regional distributions and move toward a more integrated agricultural economy,
- b) create a more integrated rural structure comprising broad and continuous spectrum of farm size holdings, and
- c) enhance factor mobility, ensure greater security of property rights and establish more equitable access to incomes and resources (Christiansen, 1993).

3. LABOUR AND LABOUR PRODUCTIVITY

Unavailability of labour can be a constraint to production especially at critical times of the year when labour is required to perform activities like land preparation, weeding and harvesting. Labour productivity of small-scale farmers continue to be lower than that of large scale sector. This may be

attributed to a number of reasons. The movement of workers to urban areas and other sectors has largely consisted of younger people leaving the aged and children in agriculture. With the traditional tools and equipment these older farmers find it more difficult to deal with some of the strenuous activities. The amount of time allocated to leisure therefore almost seems equal to that of productive activities (Spio, 1987).

According to Ruthenberg (1971), labour productivity is further hindered by the acute seasonality of many climates, with wide differences between the wet and dry seasons. The urgent need for high labour input during the period after the first rains often coincides with the period when fresh high quality food is scarce; low nutritional levels inhibit workers and draught animals from working to full capacity. This season contrasts strongly with other months in which little work to assist crop production can be done, and in which workers are therefore idle, leading to low average returns to labour, unemployment and low incomes. Spio (1987:57-58) argues that seasonality of labour - labour shortages during busy periods and surplus labour at the slack periods - causes fluctuations in the marginal productivity and opportunity costs of labour.

The systemic labour constraints are compounded by the effects of climate, health, and nutrition. Work capacity declines very rapidly with rising temperatures as also with declining health. An important insight from data collected in northern Malawi is the relationship between labour demands and health: most illnesses were reported towards the end of the rainy season (February - April) and most deaths during the March-June - explained largely by reduced food availability, heavy workloads, dampness, and water problems in the house. In humid tropical and sub-tropical climates, only light work is possible during the midday and early afternoon hours when there is no shade. Heavy work must be interrupted by frequent and prolonged rest periods. If people are poorly nourished and / or afflicted with diseases, their capacity for hard and sustained work is further diminished (Cleaver & Schreiber, 1994:126). Undernutrition is an important factor in many countries. A survey conducted in Tsolo in the Eastern Cape of South Africa, indicates that households with incomes below that required for a nutritionally adequate diet have lower agricultural outputs. The state of health of the farmer/worker at different times of the year will also affect the subjective costliness of a given amount of effort. Thus a vicious cycle between malnutrition and low food supplies exists (Westcott, 1977:140).

The importance of traditionalism cannot be overemphasised. The inherent conservatism and inertia among cultivators may be a possible explanation for the failure to adopt more efficient methods even if these may improve family

living levels and labour productivity. Some authors believe that customary social arrangements interfere with the profit-maximising behaviour of labour in agriculture (Westcott, 1977:139).

To overcome some of these problems, it is suggested that various mechanisms must be put in place by policy-makers to:

- * redesign tools in order to simplify work, improve work rate and increase productivity;
- * encourage farmers to adopt scientific methods of production, in addition to the provision of agricultural machinery at service centres;
- * supply of herbicide together with sufficient supervision by technical staff; and
- * create non-farm activities that will use labour during the slack periods, eg. the development of roads, water works and similar infrastructure are cases in point

4. TECHNOLOGY AND DIFFUSION OF INNOVATIONS

Technological advance has repeatedly been illustrated to be a major vehicle to economic development, including agriculture (Groenewald, 1993). To make impact, technological advances should meet Hunter's three inexorable laws of innovation: i) The new practice must be feasible; ii) for the small farmer it must pay him better than his present practice; and iii) its products must be marketable (Hunter *et al*, 1974:236). These three elements are lacking in the delivery system of technological advances in many developing countries. Most technology generated is not appropriate for small farmers; they are often generated in conditions different from those under whom small farmers operate. Available technology is neither resource mix neutral nor scale neutral and more or less favours larger units; are appropriate only under conditions with relatively more abundance and lower prices for capital, compared with labour that is commonly found in the Third World countries, including Sub-Saharan African (Groenewald, 1993). The availability of worthwhile innovations suited to the needs of small-scale farmers in a variety of agro climatic zones, and the strategies used to promote the diffusion of technical information appear to be deficient (Kenneth *et al*, 1979:246).

A 1987 review by the World Bank of agricultural research in East and Southern Africa noted that the impact of agricultural research on economic growth had

been less than experienced elsewhere because of a number of particular characteristics of Sub-Saharan Africa.

- * The relative insignificance of irrigation and the large agroecological diversity in rainfed farming in Sub-Saharan Africa.
- * The hostile physical environment (drought, fragile soils) and the more complex systems of farming that African farmers employ to diminish risks and conserve fertility.
- * The relative shortage of labour at peak periods of demand for farm labour, which makes mechanization (not necessarily tractorization) important; at the same time, trypanosomiasis raises unique obstacles to the use of animal power in many areas.
- * Inadequate macroeconomic policies, which have exacerbated deteriorating world market conditions and limited farmers' incentives to adopt new technology and expand production.
- * The relative low efficiency of agricultural support services (extension, input distribution, credit, marketing, and seed production).
- * The fact that small countries find it difficult to sustain both adequate agricultural training and a minimum research capacity to test and adapt imported technology to an often wide range of agroecological conditions (Cleaver & Schreiber, 1994).

Most African extension services have been geared toward technical problems and have ignored farm management and marketing (Eicher and Baker, 1982; Groenewald, 1993). Extension education contributes to agricultural development only when there are profitable innovations to extend. Most extension systems in Africa are lacking this ingredient. Extension services can meet the needs of small-scale farmers, only if research institutions provide a flow of profitable innovations to agriculture. There are various constraints: the failure to make research relevant to actual conditions on the farms; lack of trained manpower and limited financial support. These must be addressed. In addition, the low educational level of most small-scale farmers makes it imperative for research institutions to come out with readily adaptable and simple innovative practices. The innovations should not be expensive and not financially beyond the means of the farmers and must yield good and dependable returns. Karr (1976) stresses the importance of examining the present situation and organisation and also the future outlook for development of agricultural research in terms of both

practical needs and long-run priorities of small-scale agriculture. Research and extension should move towards problem-solving endeavour under field conditions, rather than continue along lines of narrow disciplinary interest.

Policy makers need to revitalise national extension organisations, improve their management, provide regular practical training to extension workers, and bring them into more frequent and fruitful contact with farmers (Russell, 1990:4). National research priorities must relate to the specific agroecological and socio-economic characteristics, production patterns and development objectives of each country. Each country needs to test and adapt technology under its own specific conditions. An intimate understanding of local constraints such as soil conditions, pests and diseases, moisture variation, seasonal labour shortages, and the gender aspects of farming system is essential in this regard (Cleaver & Schreiber, 1994:153).

The development of appropriate technology is a necessary, but not sufficient, condition for ensuring its adoption. One must also design a system of technology transfer that provides farmers with the input and information needed to enhance productivity. Likewise, the extent to which farmers use information related to improved crop, livestock and resource management depends on the effectiveness of extension services and of other communication media and on farmers' level of formal schooling. The technological transfer system suggested by Byerlee and Heisey (1990:29) may be appropriate within the African context. (See Figure 1).

In the early phases of input adoption and production intensification, the major impetus for change comes from institutions and policies supporting the development of input supply systems and from the availability of input-responsive modern varieties. The important elements of the policy environment at this stage, as indicated on the right hand side of Figure 1, are price policy and input supply systems.

Extension plays a supporting role at this stage, serving primarily to stimulate adoption of inputs. As the policy and institutional environment evolves and farmers begin using higher levels of inputs, adaptive on farm research and extension become increasingly important for providing improved information that help farmers employ inputs more efficiently. The emphasis in technology then shift to lower left hand side of Figure 1.

5. PROVISION OF FINANCIAL SERVICES

The provision of financial services to small-scale farming has been static and have even declined in certain instances because of the risk involved in dealing with farmers. In a bid to correct these market failures, some governments and developing aid agencies have rapidly expanded the volume of their agricultural loans. (Adams & Vogel, 1989). Subsidised interest rates on loans caused subsidised lending projects to be narrow in scope and devoid of growth, causing a wide gap between supply and demand for credit. This resulted in the rationing of credit to farmers (Seibel, 1994:21). The following factors caused

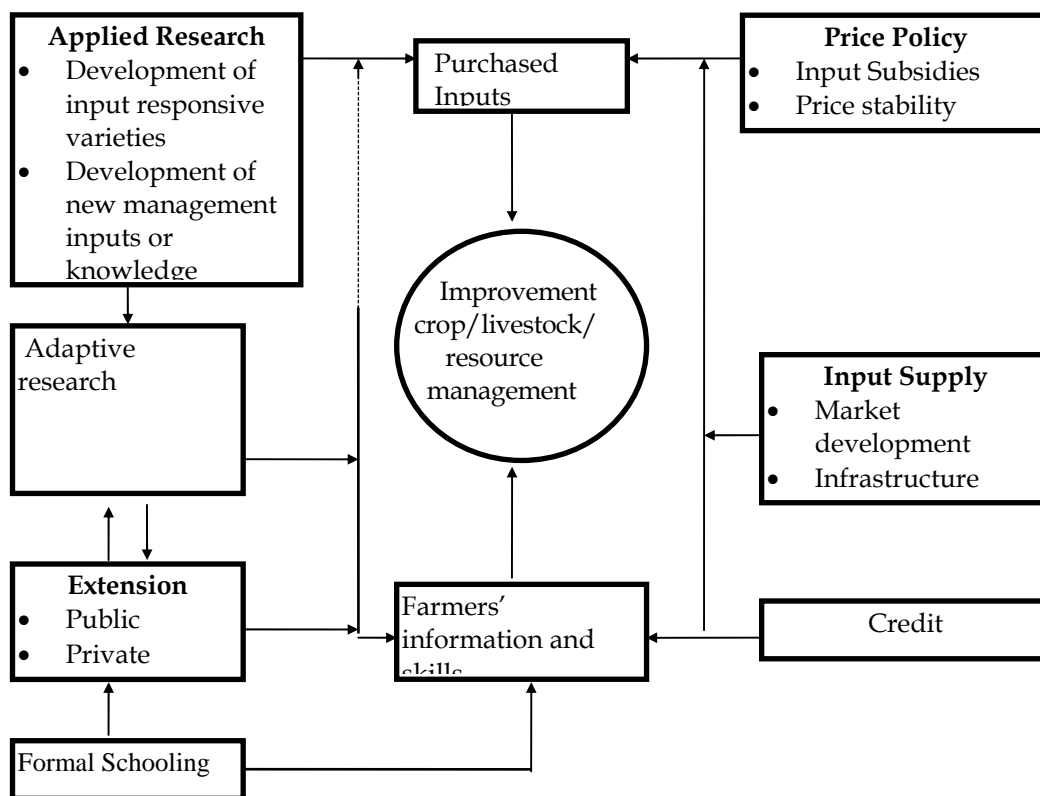


Figure 1: Technology transfer system

Source: Byerlee and Heisey, 1990:29

reticauce among lenders to expand such credit:developmental strategies in the 1970s. Inevitable limitations in the availability of:

- * extensive losses due to lack of repayment discipline have weakened many institutions (Boakye-Dankwa, 1979). Loan delinquency and default have plagued agricultural credit programmes in low income countries, especially agricultural development banks (Adams & Vogel, 1989; Braverman & Gausch, 1986);
- * low interest rates for credit normally led to low interests on deposits, thus hampering the growth of savings and preventing financial institutions from becoming financially independent (Adams *et al*, 1984; Von Pischke *et al*, 1983);
- * high loan transaction costs have discouraged lenders from serving certain groups of farmers. World Bank studies show the lender cost of agricultural loans to medium and small-scale farmers to be 20% or more of the value of the loan itself.

These above mentioned factors caused the financial institutions to adopt a lukewarm attitude towards financing agriculture. Borrowers have also had problems:

- * Credits are conditioned chiefly by securities in the form of land or other assets. Most small-scale farmers cannot satisfy this requirement because of poverty and tenure arrangements.
- * The cost of borrowing has been high, as has been the risk of failing to obtain credit or obtaining it too late (eg. after planting) (Adeyemo, 1982). Borrowers' cost of acquiring formal loans can be substantially larger than the interest (Adams & Nehman, 1979). International Fertilizer Development Centre Verification Survey Report (1989) reveal that total borrowing costs of small-scale farmers in Ghana may be two or three times as high as interest payments.
- * Bureaucratic red tape (Heidhues, 1985): The complicated, cumbersome and time consuming operating procedures result in delays in approval, and loans are not made available when required.

However, the financial markets can still make an impact if governments put into place an appropriate framework and rational planning of agricultural credit policies (Heidhues, 1985). The mere supply of credit to farmers may bring more problems than it solves, if not backed with necessary ingredients. An effective analysis of the role of credit in agricultural developments needs to be time, place and farmer specific (Adekanye, 1983). Successful implementation of credit schemes requires the availability of improved technologies; practical demonstration of the improved methods, which farmers are anxious to adopt; timely supply of agro-chemicals; improved seeds etc. The supply of credit must be on time and the market must guarantee remunerative pricing for farmers' output. Agricultural credit institutions can also contribute to greater credit access for farmers by basing credit decisions more on profitability and productivity than on guarantees or securities.

For sustained growth to be achieved in the financial sector of most African countries, the constraints mentioned above must be overcome. This calls for policy reforms which should include the following elements: a market perspective that understands the preferences of the client group and designs products to meet them; a recognition that savings can be as important as credit; and insistence that financially viable institutions provide financial services through the development of cost effective innovations that will be able to address the issue of high transaction costs, and high delinquency and default

rates which reduce accessibility and sustainability of financial institutions. To ensure the possible attainment of the above objectives, a conducive policy environment, institutional environment and instrumental environment should form the basis of the framework for finance and rural financial institutions

6. MARKETING AND INFRASTRUCTURAL DEVELOPMENT

Underdeveloped marketing systems and inadequate infrastructure have resulted in gluts during harvest seasons and scarcities in off-season in most Sub-Saharan African countries. An increase in agricultural output that is not accompanied by an improved distribution and marketing system may yield three important complications (Anthonio, 1971): i) Lower prices and reduced incomes for the producers; ii) wastes at the farm gate or somewhere else along the distribution channel because produce are not handled and stored properly; and iii) Ad-hoc policy solutions which sooner or later become ineffective.

Lack of efficient and adequate storage facilities constitute one of the serious problems confronting the small-scale farming sector. In Ghana, poor traditional post harvest management led to losses of up to 20% (Min. of Agric and Food - Ghana, 1990). This obviously reduces food availability and hence causes drastic seasonal price fluctuations of major food crops. Storage facilities should thus be provided at various producing centres so that the farmer will not be forced to sell his produce at lower prices during the peak periods. Appropriate storage cribs must be based on materials readily available to farmers; economical chemical treatment of grains against insect damage will also reduce losses of produce.

Lack of contact between the producer and the market has also resulted in losses in farm produce. Most roads in producing areas are in a poor state, making the transportation of farm produce to the marketing centres difficult or virtually impossible. In some cases roads linking producing areas and marketing centres are non-existent. Poor transport networks complicate problems where storage facilities are insufficient and thus influencing prices of foodstuff. The contributing factor is the poor economic conditions of most African countries. Improvement in transport will invariably boost other sectors of the economy.

Most produce markets in Africa are poorly served with information. Governments should provide marketing information about supply situations, prices, and production levels. Improvements in the marketing information system through regular market and trends newsletters, radio reports and quarterly bulletins will improve marketing immeasurably. Public monopolies in the supply of inputs created an irregularity and inadequacy of supplies and also

higher prices for seed, fertilizer and other necessary inputs. There is a need to break the old tradition of government involvement in agricultural marketing. There is sufficient evidence that parastatal marketing entities in Africa have caused marketing margins to exceed those in other developing countries (Spio & Groenewald, 1995).

7. ENVIRONMENTAL DEGRADATION

Agriculture is, and always has been, an activity involving a close interaction with the environment, which is a combination of physical and institutional conditions. These factors exert a major influence on farming operations and their profitability. Agriculture modifies the environment; incorrect farming practices may adversely affect the environment (Briggs & Courtney, 1989). Agricultural development increases the potential for resource deterioration and even destruction. The construction of reservoirs, the development of irrigation projects, mechanization and the use of chemicals react with the environment in a number of ways that may have disruptive effects (Arnon, 1980). Adverse environmental effects immediately affect the poor, urban and the rural, through health consequences of urban air and water pollution; crop losses from increasing erosion; consumption losses as a result of forgone production of minor forest products; increased labour costs to gather water and fuelwood; crop losses and damage to irrigation systems due to the destabilisation of hydrological patterns. The developed and the developing countries are faced with similar environmental degradation, but the World Bank Report (1989) states that these problems differ in their economic source, scope and significance. For developed countries, it is growth and over-development, while developing countries face lack of growth and poverty.

7.1 Poverty and degradation

The Late Indian Prime Minister, Indira Gandhi, commented that poverty is the "worst polluter". Poverty plays a greater role in the depletion of soil, forest and biomass. Poverty, combined with rapid population expansion, forces the poor to exert unsustainable demands on natural resources through overgrazing in reduced common spaces, deforestation to expand the agricultural frontier or to obtain fuelwood, and pollution from systems of waste disposal and energy use (World Bank, 1989). The poor depend on the natural environment for their survival.

7.2 Common property and degradation

Many environmentally fragile areas of the world are common property. Excessive environmental degradation may thus be associated to Hardin's "tragedy of the commons". Most case studies appear to support the hypothesis of subsistence of the poor combined with open access to resources as a key factor in resource degradation. Many commentators regard lack of internalisation of the externalities by farmers to be the cause of environmental degradation. These spillover effects, although noticed, are left unpriced and hence the bearers are normally uncompensated in the private market environment. According to Lopez (1992) an improvement in prices faced by peasants under subsistence reduces environmental degradation, while it increases degradation under the externality hypothesis. Improved prices allow farmers to reduce the gap between their minimum subsistence requirement and their income. This permits them to disinvest less in their environmental factors. However, if the source of degradation is an insufficient account of the externalities rather than subsistence, an increase in their price will raise the marginal value product of the environmental resources, thus causing greater extraction and degradation.

7.3 Modernization and degradation

The displacement of peasants and the destruction of their institutions substantially increase their impoverishment and generate secondary environmental degradation. Internal sources, such as population growth and westernization of the traditional communities tend to weaken community structures and control over community resources particularly Sub-Saharan Africa. This in turn, leads to over-exploitation and degradation of natural resources.

The Green Revolution and other policies, which have helped to boost agricultural production, have in some way contributed to the environmental problems. Most of the problems resulting from Green Revolution Technology have arisen because i) the classical socio-economic benefit cost analysis have limited application in the assessment of the importance of environmental problems and ii) wrong use of some of the modern inventions like insecticides. Virtually every ecosystem in Sub-Saharan Africa has been modified or transformed by human activities, leading to extensive environmental degradation.

For instance, the great increase and wrong use of pesticides has become a threat to the environment. Research conducted in some African countries shows that death in many wild animal species, including insects, fish, birds and certain mammals are associated with insecticides like Dieldrin. Seventy per cent of the death caused by pesticides comes from the Third World, which only uses 21 per

cent of pesticides sold in the world. Again, the persistency of pesticides in the soil disturb the maintenance of the equilibrium between the various components of the complex populations of micro-organisms in the soil and can alter the ecology of aquatic ecosystems sufficiently to destroy populations of animals associated with plants. The spread of irrigation in many African countries has caused an increase in waterborne diseases such as bilhaziosis and malaria. Irrigation has also contributed to huge tracts of land being lost to crop production because of salinisation brought about either directly as a consequence of the accumulation of salts carried by the irrigation waters or indirectly through the rise of ground water tables (Alagh, 1988; Koeman, 1978; White, 1977; Biot, 1990).

The environment and natural resources have a great impact on society and therefore deserve the attention of the state. The preservation of natural resources is not a goal for its own sake, but must be directed towards elevating the quality of life. Numerous effective and low-cost or no-cost techniques can be made available to farmers that would permit intensification and greater sedentarization, improve yields, and maintain soil fertility. Which of these are appropriate - technically and economically - depends very much on local conditions. Among these are:

- (1) Broad technical approaches to conservation involving prevention, control and rehabilitation measures emphasising prevention, and not allowing degradation to start;
- (2) mechanical preventive and control methods under the general term conservation tillage and cross slope barriers;
- (3) biological preventive and control methods involving methods like cover crops, rotational grazing, agro-forestry, multiple, inter and relay-cropping; and
- (4) Farming system/household-level interventions eg. promotion of certain crops by subsidisation.

Embarking on sound physical land use planning, watershed development, and controlling access and land alienation interventions as well as providing sound institutional and legal framework on the use of natural resources are some of the roles governments can play to protect the environment and depleting natural resources.

8. CONCLUDING REMARKS

As the drive to boost agricultural production becomes very desperate in the face of rising population numbers in Sub-Saharan Africa, the small-scale farming sector continues to live in a "dilemma of problems"; it continues to have very low per capita food supplies and has hardly made any progress. However, the realisation, together with the evidence that the World as a whole faces no major constraints in increasing food production by more than required to meet the growth in effective demand, should convince governments of African countries of the need to design and implement policies and programmes directly aimed at improving production in the small-scale sector. Access to the market through appropriate price and income programmes, direct help and basic assistance are required. Efforts to remove backward production techniques, investment in human capital, provision of economic opportunities which are rewarding, and instilling the spirit of entrepreneurship in small-scale farmers will go a long way to reduce the weaknesses encountered in the small-scale farming sector. The following requirements are essential if those policy options suggested in the paper are to be achieved: i) A stable political and social institutions and ii) favourable economic policy environment that allows market incentives to be passed along to farmers and encourages the private sector to invest in agricultural production, processing and marketing. In a nutshell, Sub-Saharan African governments should be "better governments" as opposed to "less governments".

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