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Food Security or Food Self-Sufficiency: Why should Africa increase its food Production?

by Prof. S.C. Nana-Sinkam¹

I. The Challenge of Food and Food Security

"Self-reliance we have always defined in ECA to encompass three sub-sets of objectives within the major socio-economic objectives:

- the internalization of the forces of supply and demand which determine the direction of development and economic growth processes and patterns of output;
- increasing substitution of factor inputs derived from within the system for those derived from outside; and
- increasing participation of the mass of the people in the production and consumption of the social product."

(Prof. Adebayo Adedeji, United Nations Under-Secretary-General and Executive Secretary of the Economic Commission for Africa at the 25th Assembly of Heads of State and Government of the Organization of African Unity).

As far back as 1974, the World Food Conference optimistically declared that "no child should go to bed hungry". It has now been practically a decade and a half since this declaration was made. Nonetheless, millions of people including men, women and children are still going to bed poor and hungry with some of them even dying of starvation. According to the World Bank, 730 million people (excluding China) subsisted in 1989 on a diet providing inadequate energy for an active working life. Of these 340 million had diets which were insufficient to prevent stunted growth and grave health hazards. The share of sub-Saharan Africa in this position was the highest.

For Africa as a whole, the number of hungry and malnourished people in the 1970s was in the vicinity of 80 million. By 1984, this had snowballed to more than 100 million. Currently, it is estimated to be within a range of 140-150 million. In other words, the poor and hungry people in the region

almost doubled in less than a decade. If the situation continues unabated and the region's population grows at the present rate, the number of the poor and malnourished will reach a level of not less than 300 million by the year 2010. This horrifying development will certainly exacerbate the scale of the region's food crisis and have very serious implications for its food security.

The World Bank defines Food Security as: "access by all people at all times to enough food for an active and healthy life". Its essential elements are the availability of food and the ability to acquire it. Food insecurity, in turn, is the lack of access to enough food. There are two kinds of insecurity: chronic and transitory. Chronic food insecurity is a continuously inadequate diet caused by the inability to acquire food.... Transitory food insecurity is a temporary decline in a household's access to enough food. It results from instability in food prices, food production or household incomes and, in its worst form, it produces famine" (World Bank 1986).

By focusing attention on seasonal and inter-annual variation in entitlement to food and by stressing consumption over production, the World Bank definition has many strengths. However, it underplays subjective attitudes to food and neglects food security questions at the regional and national levels.

An alternative and complementary definition of food security is given by Maxwell (1988) and reads as follows:

"A country and people are food secure when their food system operates in such a way as to remove the fear that there will not be enough to eat. In particular, food security requires that the poor and vulnerable have secure access to the food they want. Food security will be achieved when equitable growth ensures that these groups have sustainable livelihoods: in the meantime and in addition, however, food security requires the efficient and equitable operation of the food system" (Maxwell 1988).

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Defined succinctly, the concept of food security is nothing, but an assurance that every country will have enough food supplies to meet its emergency requirements through, *inter alia*, the establishment and maintenance of basic food stocks. The need for such an assurance is more seriously felt not in normal years, but in periods of calamitous events such as the 1984-85 devastating drought, which hit several African countries like Ethiopia, Chad and the Sudan.

The basic objective of food security is, therefore, to increase food availability; to balance annual supply fluctuation; and to improve food distribution. In order to attain this objective, the three groups of people identified below should be considered:

- (i) People in areas unfavourable for food production and poorly served in terms of food, transport and marketing from other areas;
- (ii) People too poor to obtain adequate food, particularly the urban unemployed, casual labourers and landless agricultural workers; and
- (iii) Pregnant and lactating women, their babies and young children (who have special nutritional needs) as well as nomads.

While the immediate objectives of food security is to meet the needs of these disadvantaged groups of people, its long-term objective is that of ensuring adequate provision of food for all people both in quantitative and qualitative terms. Generally speaking, the policy strategies of African countries reflect some elements of the foregoing objectives as stated in the Lagos Plan of Action (LPA); the United Nations Programme of Action for Economic Recovery and Development (UN-PAAERD) 1986-90, replaced by the United Nations New Agenda for the Development of Africa in the 1990s (UN-NADAF); and the African Alternative Framework to Structural Adjustment Programmes (AAF-SAP). The countries development goal of food self-sufficiency and their policies of price stabilization as well as subsidies are ample manifestations of their concern for the welfare of poor consumers, who have little or no access to food.

Despite such an apparent concern, the danger of food insecurity is menacing a growing number of people in the region as indicated above. The genesis of food insecurity in the African context may be summarized into four, major

domains. These include: decline in purchasing power; deficiencies in internal marketing and distribution systems; poor or non adapted policies preparedness measures at all levels; stagnant and/or lack of technology and decreasing yields; and limited food availabilities usually characterized by stagnating or even decreasing food production.

At national level, Food Security is often interpreted in terms of price stability; i.e. avoiding sharp increases in food prices. Such concern is highly justified, given the importance of food in overall consumption, particularly for the poor strata of the population.

Developed countries which, on an opportunity cost pricing basis, would continue to find themselves reliant on the world market for part of their overall food supplies, are often reluctant to accept such outcome because of the uncertainty in international food markets. Because prices of imported food (grains, meat, etc...) are uncertain, many developed countries feel justified to adopt policies which distort prices away from the international terms of trade in order to increase their self sufficiency ratio in food production (cases of EEC, USA,...). It has been shown in theory that, in the presence of international price uncertainty, the expected utility-maximizing output bundle is not that generated under free trade, even after correcting for domestic distortions; rather, expected utility is maximized at that output bundle which is produced when domestic prices are distorted away from the international terms of trade by the subjective cost associated with the international price uncertainty².

From different analysis made, it could be concluded that food security considerations may justify a greater degree of food self-sufficiency provided two criteria are met: (a) the degree of variability in import bills is high relative to domestic production; and (b) the country faces a foreign exchange constraint. These are definitely the characteristics of African countries! It is true that the need for criterion (b) points to the fact that higher domestic food production is a second best approach. In fact, if the problem is a foreign exchange constraint, the first best-solution would be to tackle this directly through compensatory financing mechanisms of the IMF or international food insurance schemes. However it seems unlikely, that such mechanisms would ever attain the degree of automaticity which would remove countries' reservations entirely.

2. Jabara, C. and Thompson, R. (1980) "Agricultural comparative under international price uncertainty: the case of Senegal", *Am. Jnl. Agricult. Econom.* 62: 188-198.

II. Trends in Food Production

The irony of Africa's food and agricultural development strategy is the co-existence of food insecurity with abundant natural resources capable of substantially increasing food availabilities. The region has a capacity to feed virtually three times the size of its present population although 47 per cent of its land surface is useless for crops. It has tremendous potential for arable agriculture compared to other regions of the world. According to one estimate in the mid-1970s the continent had 25 per cent of the world potential arable land while its population was only a tenth of the world's population. Currently, the land under cultivation is estimated at 195 million hectares and this is only 26 per cent of the region's potentially arable land. Of this, the land harvested annually is not more than 108 million hectares. Clearly, Africa is not resource poor. If so, what has gone wrong?

The harrowing picture of food insecurity can be traced mainly to the region's poor food and agricultural production performance. The region's food production has seen insignificant improvement since 1960 and is now pegged at a level slightly more than 50 million tons. In 1938, the region exported cereals. In 1950, it was self-sufficient in food. By 1989, it had imported a large volume of cereals exceeding 31 million tons. The real crisis behind the region's food insecurity is the continuously declining per caput food production. As indicated in figure 1, total food production has been rising steadily since 1979. On the other hand per caput food production started falling in 1980 and reached its lowest level in 1984 after which it recovered remarkably until it commenced again its downward descent in 1986. In 1987, it sank to a low level and has since shown little or no improvement.

The region's sagging per caput food production may be explained by a variety of factors. Among these are poor production practices and inadequate supporting services. Unlike in other developing regions, production practices in Africa are primarily based not on increased yield, but on expanded area under cultivation. There has been no technological revolution. While some parts of Africa do not experience a chronic shortage of land, many parts are suffering from a shortage of good soil, of fertile land and/or arable land.

This being the case, the increase in food production emanating from expanded acreage under cultivation, rather than increased yields, has necessitated the cultivation of new often marginal land. Unfortunately, this new marginal land is often in hilly areas where yield is very poor, where the danger of soil erosion is present, where the soil is thin and needs fertilizer and where irrigation is difficult. Thus even the little increase in food

production is brought about with considerable hardship and labour. Another crucial factor worth mentioning is the subsistence type of production dominating the African agricultural economy, which is largely characterized by unskilled manual labour, poor technology, low yields, little or no investment and scarcity of inputs such as fertilizers and seeds.

The inadequacy of supporting services such as agricultural research, extension, credit and marketing has contributed to the low level of food production. In the areas of research and extension, for instance, a major problem is the academic nature and even irrelevance of most newly developed technologies and their low rates of adoption by the small farmers.

The poor response of extension services to farmers' needs and the lack of appropriate logistical support for field activities also constitute a severe handicap to food production. Still another problem area is the scarcity of agricultural credit extended to small farmers due, partly, to bureaucratic impediments or collateral requirements. The unsatisfactory performance of the agricultural marketing system particularly in the domains of storage, processing and transport has also had a negative impact on the region's food production. In this respect, difficulties experienced by farmers in marketing their surplus produce and in purchasing agricultural inputs (fertilizers, seeds, pesticides, etc.) and consumable commodities may be cited as examples. In actual fact basic assumptions upon which a food security strategy rests are founded on marketing policies and postulate that:

- (i) there is an efficient price-responsive agricultural industry ;
- (ii) essentially all food items pass through commercial marketing channels ;
- (iii) there is a price for grain at which one can buy or sell freely ;
- (iv) the influence of a trading activity in one part of the market is quickly transmitted to all parts of the market; and
- (v) reliable information on production and market performance is instantly available.

In view of the fact that the marketing system in a number of African countries is functioning in a setting largely characterized by resource constraints; infrastructural deficiencies; state intervention and institutional inadequacies; none of the above assumptions appear to hold true. As a result, the marketing system fails to serve as a reliable bridge between surplus and deficit regions within and among countries. Moreover, the poor marketing system entails considerable food losses due to bad handling, inefficient transportation as well as deficient

processing, conservation and storage practices. All these aggravate the danger of food insecurity facing the disadvantaged groups referred to above.

III. Rising Demand for food Commodities

A dominant factor behind the decline in per caput food production is the continuous rise in the region's population. Over the years the population in most African countries has been growing about 2.8 per cent annually with this attaining a level of more than 3 per cent in countries like Rwanda, Burundi and Kenya. As pointed out earlier, there is a yawning gap between the rate of population growth in the region and that of food production, which has, on the average, grown at a rate of about 1.6 per cent per annum. What makes the situation even worse is the fact that a growing number of the population constantly moves to urban areas. This does not only reduce the agricultural labour force available for food production, but it also increases the urban poor menaced by food insecurity.

The growing urbanization which swells at an average rate of 5-6 per cent annually, pushes up the demand not only to locally produced food, but also for food commodities which are not produced locally. Typical examples of these are wheat, rice, canned fish and processed livestock products. Two of the main factors responsible for this are changing food habits or tastes and rising income for a certain portion of the urbanites, who have been fortunate enough to secure gainful employment. Since domestic production cannot cover the rising demand, the countries have had to cover the food gap through increased imports of food aid. However, all countries have not been in a position to make adequate food imports or to receive food aid on a regular basis. This has

occasioned widening gaps in food requirements and resulted in severe food deficiency.

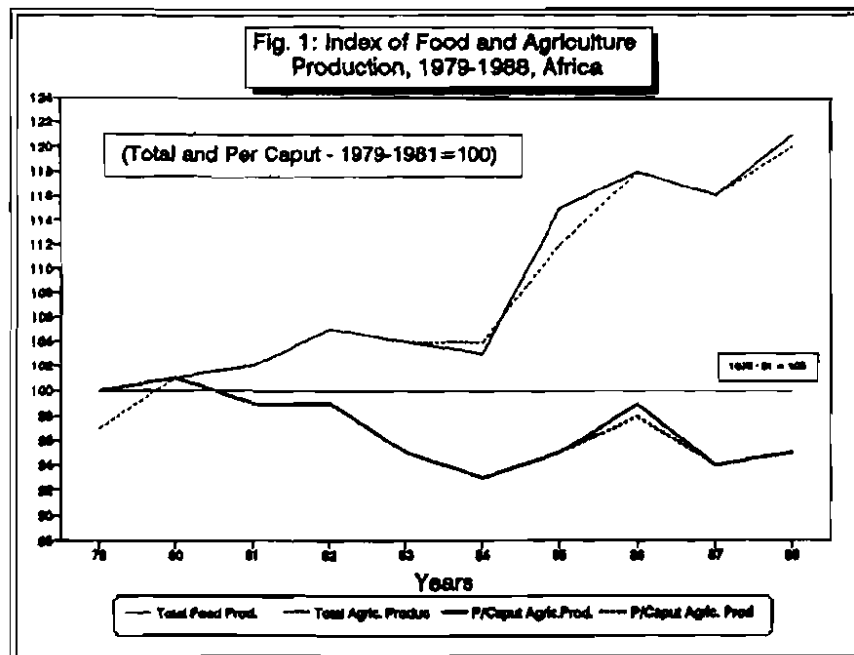
IV. Gaps in Food Requirements

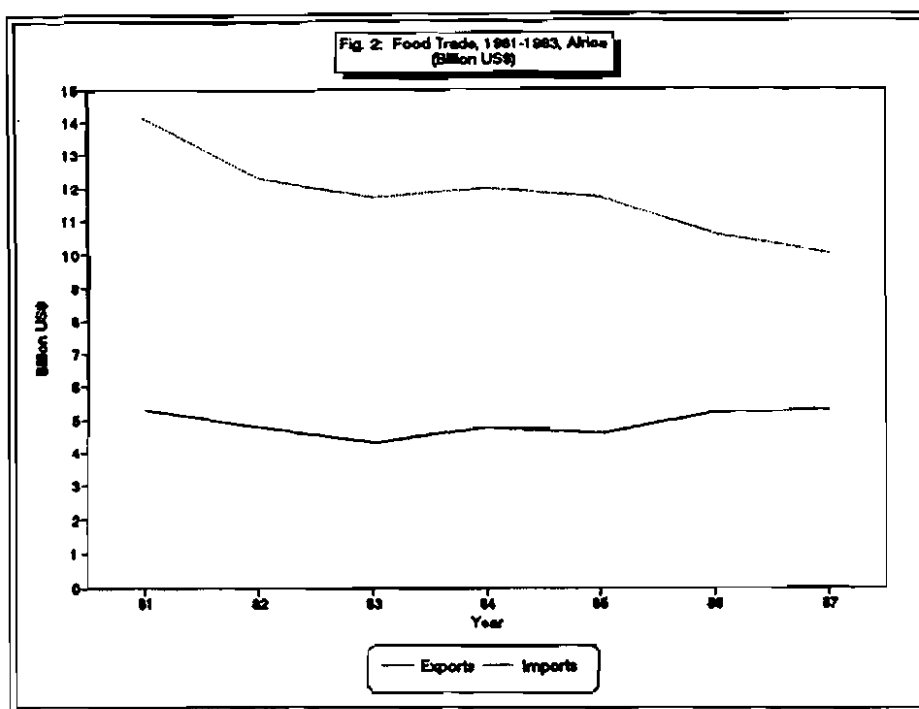
The problem of food deficiency has been existing in the region for over 25 years. As stated above, the number of hungry and malnourished people, which are collectively known as vulnerable groups, was in the neighborhood of 80 million way back in the 1970s. In 1980, 44 per cent of the population in sub-Sahara Africa or 100 million people did not have enough calories for an active working life. In the same year, 25 per cent of the population or about 90 million people in the same region did not have enough calories to prevent stunted growth and serious health risks. If the North African countries are considered, the figures will be much higher. Clearly, the situation has now deteriorated and this has worsened the danger of food insecurity.

Inadequate diets increase vulnerability to disease and parasites. They reduce strength for tasks requiring physical effort. They curtail the benefit from schooling and training programmes. They also result in a general lack of vigour, alertness and vitality. All these will compromise the region's capacity to expand food production and jeopardize its food security thereby entailing a perennial state of dependence on growing food imports and food aid.

V. Food Imports and Food Aid

In an apparent effort to bridge the gaps between domestic food production and food demand, a good number of African countries have had no choice, but to rely heavily on food imports and food aid. At the height of the 1983-85,





devastating drought one in every five Africans relied for survival on food imports a quarter of which was provided by food aid. In 1981, for instance, the region imported food commodities valued at US\$ 14 billion. As shown in figure 2, the volume of the region's food imports dropped to US\$ 10 billion in 1987. The decline in food imports is explained by several factors. Chief among these are a slight recovery in food production; limited efforts at food import substitution; and, most importantly, the countries' inability to pay for increased food imports owing to the lack of foreign exchange and to rising international prices. The reduced food production and the shrinking food imports have increased the number of vulnerable groups facing food insecurity and caused a growing food aid dependency.

Food aid has long been the principal instruments towards food insecurity of a temporary nature. It has helped low-income, food deficit countries like Ethiopia, Mozambique, Chad and Angola to sustain food supplies and protect the income to vulnerable groups. Practically 50 per cent of Africa's aggregate food import needs is covered by food aid. In the early 1960s less than 1 per cent of total world cereals food aid went to sub-Saharan Africa.

This situation dramatically changed in the years 1973/74 when the region received 20 per cent of total cereals food aid mainly in response to the major drought largely affecting the Sahelian countries. Between 1979/80 and 1984/85 the percentage of cereals food aid going to sub-Saharan Africa jumped from 17.1 per cent to almost 40 per cent. In volume terms, this represented an increase of 3.3 million tons. Between 1983/84 and 1988/89, the volume of cereals food aid leaped from 2.7 million tons to 3.3 million tons. This represents an increase of 22 per cent. Despite this, the per caput availability of food aid has not shown

a significant improvement. Moreover, the aggregate figures mask some sharp differences in food aid receipts and food availability among countries. Table 1 shows the percentage share of food aid in total cereal imports for selected African countries.

Table 1 - Cereal imports and food aid

Country	Cereal imports and food aid	Country	Cereal imports and food aid
Ethiopia	97	Somalia	52
Zaire	17	Burkina Faso	92
Tanzania	43	Egypt	23
Kenya	56	Niger	73
Mozambique	84	Senegal	20
Ghana	30	Madagascar	36
Zimbabwe	63	Cameroon	4
Sudan	100	Tunisia	14
Zambia	36	Sierra Leone	26
Mali	65	Togo	15
Chad	85	Benin	13
Morocco	13	Liberia	34
Congo	3	Mauritania	49

Source: Food Policy, Vol. 3, August 1989, p. 211.

VI. Declining Purchasing Power of Vulnerable Groups

A glaring manifestation of poverty and food insecurity is also the lack of adequate income. Vulnerable people with no income-earning capacity remain food-insecure and are subjected to malnutrition even if food is available as long as they do not improve their purchasing power based on sound "entitlement relationships" mainly involving possession of land, sale of labour power and viable government programmes. This is substantiated by the recent emergence of food surpluses not finding remunerative market outlets in some African countries following good weather despite the prevalence of widespread hunger and malnutrition in the region. Particularly so in a situation where the price of basic food commodities tends to be high thus rendering access to food even more problematic. According to the FAO, cereal prices continue to be high. In April 1991, for instance, the price of wheat was higher than that of 1988 by 37 per cent. The corresponding increase for maize was 20 per cent.

The fact that the income-earning capacity of the vulnerable groups is lamentably low is evident from the region's overall economic performance. More than three years after the adoption of the United Nations Programme of Action for African Economic Recovery and Development (UN-PAAERD), replaced by the United Nations New Agenda for the Development of Africa in the 1990s (UN-NADAF), it is still widely believed that the performance of Africa's economies remains dismal. In 1986, the gross domestic product (GDP) of the region rose by 1 per cent and in 1987 by 0.8

per cent. Simultaneously, per capita income fell by 2 per cent and 2.2 per cent in those years. An analysis of country-by-country data suggests that GDP growth for 1986 and 1987 was negative and, if positive, trailed behind population growth. The net result of this pathetic economic and social situation is a pernicious decline in the human condition and, hence, a pronounced deterioration in the region's food security problems thereby entailing severe hunger and malnutrition. As shown in table 2, the number of people facing malnutrition in the region is substantial.

Table 2 - Number of people facing malnutrition in selected sub-Saharan countries.

Country	Number of people (millions)	% of total
Ethiopia	14.7	46
Nigeria	13.7	17
Zaire	12.0	42
Tanzania	6.6	35
Kenya	6.2	37
Uganda	6.1	46
Mozambique	5.9	49
Ghana	4.1	36
Sudan	3.4	18
Zambia	2.7	48
Mali	2.5	35
Chad	2.4	54
Somalia	2.3	50
Burkina Faso	2.0	32

Source : World Bank, 1988

Table 3 - Direct impact of some intervention measures on chronic food insecurity

Kind of intervention	Effect on chronic food insecurity						
	Price of food	Urban poor		Rural landless		Small-scale farmers	
		Nominal income	Real income	Nominal income	Real income	Nominal income	Real income
Increasing the food supply							
Trade							
Reducing imports	+	0	-	(+)	(-)	+	+
Expanding imports	-	0	+	(-)	(+)	-	-
Subsidizing food production							
Traded foods	0	0	0	(+)	(+)	(+)	+
Nontraded foods	-	0	+	(+)	+	(+)	(+)
Subsidizing food prices for consumers (while maintaining producer prices)							
Targated or marketwide	-	0	+	0	+	0	+
Augmenting incomes							
Targated or marketwide	0	+	+	+	+	+	+

Note: 0 = no effect; + = improvement; - = deterioration. Parentheses indicate a slight effect.
Source: A world Bank Policy Study. Poverty and Hunger, Issues and Options for Food Security in Developing Countries, 1986

Table 4 - Structural Adjustment Policies

Type of Policy	Macroeconomic Instruments	Sectoral (Agricultural) Instruments
1. Pricing Policy	Exchange rate, Wage rate, Interest rate	(Administered) output prices, Wage rate, Irrigation charges, Agricultural interest rate
2. Fiscal Policy	Subsidies, Tax rates, Public expenditure (including Public investment)	Subsidies, Tax rates, Public expenditure (including Public investment)
3. Monetary Policy	Money supply targets, Interest rate, Credit allocation	Targets for agricultural credit, Agricultural interest rate
4. Trade Policy	Tariffs and quotas, Export subsidies	Tariffs and quotas, Export subsidies
5. Institutional Reform	Monetary management rules, Management of parastatals, Divestiture of public enterprises	Marketing board reform, Reduction of intermediation costs in agricultural banks, Improved agricultural research
6. Land Policy ¹	Cadastral surveys, Land taxes, Zoning	Cadastral surveys, Land taxes, Land titling, Sale policy on public land, Consolidation of scattered parcels

Source: Adapted from Norton (1987).
 1. As a prerequisite to land reforms, emphasis is being given to broadening of the legal framework applicable to (i) consolidation and prevention of land fragmentation; (ii) expropriation and land transfers; (iii) privatization of collective and included in consolidation schemes: land leases (duration, suspension, registration, etc.). For Further details, see Seddon (1987).

It had been argued that solutions to overcome undernutrition in Africa can be greatly influenced by the "entitlements" approach, which is in contrast to the "availability" approach. People gain entitlements to food in many ways: through possession of land, the sale of labour power, and/or through government programmes. It can be argued that undernutrition reflects the lack or breakdown of entitlements relationships rather than the lack of food itself. In contrast to the availability approach, increasing the supply of food will not affect the extent of undernutrition unless the poor have their entitlements restored or increased in one of the three ways mentioned above. One could be attempted to conclude that an increase in food-self-sufficiency will not have a direct effect on the nutritional status of the poor. However, it could be argued that increasing food production may be one way to provide the poor with increased entitlements: (a) since in Africa, food production is predominantly in the hands of smaller farmers (including women), support for domestic food production would redistribute income in their favour; (b) since, within farm households, food production is mainly the responsibility of women, and they dispose over the distribution of increased output, support for domestic food production would also improve intra-family nutrition.

VII. Policy Instruments and Intervention

As indicated earlier, the food security situation has worsened over the years in the region. All the same, it does not follow from this that nothing has been done by African countries to mitigate the gravity of the situation. Indeed, a number of encouraging measures have been taken

not only by the countries, but also by the international community at national, subregional, regional and international levels. Whether or not all the measures so taken have served the objectives they have been intended for is a different question.

The policy instruments and intervention measures commonly employed by the countries to improve the region's food security revolve round mainly six areas. These are determination on control of food prices; application of food subsidies; stabilizing food supplies; balancing domestic food demand; raising the income of vulnerable or disadvantaged groups; and strengthening interstate co-operation in food trade. For this purpose efforts have been made to build food reserves; to secure food aid; to make food imports; and to establish early warning (information) systems. Table 3 portrays the possible impact of the policy measures on chronic food insecurity. In practically applying the policy instruments and intervention measures, the countries in the region have been faced with numerous problems. To begin with, countries trying to stabilize food supplies and prices often do so in a costly and ineffective fashion. They utilize quantitative controls on imports and exports of foods - controls that necessitate substantially more information on supply and demand than public marketing agencies typically have. Even when this information is available, the agencies seldom have the managerial resources and competence or the requisite political support to act promptly and efficiently. Consequently, policy intervention often aggravate, rather than reduce, the instability of supply and prices.

In addition, some countries keep excessive buffer stocks. Large stocks are seldom cost-effective because of high storage losses, low

capacity utilization of storage structures and high interest charges on capital tied up in inventory. The utilization of food aid is also believed to have had a negative impact on the attainment of long-term food security objectives. It is often argued that food aid is dangerous and potentially harmful because by bringing in free imported food it tends to lower national food prices and act a disincentive to increased food production. That is a real danger, but food aid can be administered and used in such a way that it provides an incentive to producers. A related danger is the inappropriate utilization of food aid, which in some cases goes into private pockets to fatten external accounts.

Structural Adjustment and Food Security

There is a large policy overlap between structural adjustment and food security. Table 4 shows the types of measures requested by the IMF and/or the World Bank in return for stabilization and/or structural adjustment lending. Changes to output prices, wage rates, subsidies or taxes, tariffs or institutional arrangements will all affect the production, marketing and consumption of food.

In general, the impact of structural adjustment on food security will be mediated through the impact on growth income distribution, the level and stability of food production, food exports and imports and the level and stability of producer and consumer prices.

A typical stabilization and/or structural adjustment package might contain some or all of the following measures directly affecting the food security:

On production: shift relative prices in favour of export crops, higher charges for inputs and services; increased interest rates for credit;

On marketing: reduction in role of public sector; smaller buffer stocks; liberalize imports and exports;

On consumption: reduce general consumer subsidies by increasing food prices; increase in targeting of food and nutrition interventions; cuts in health and education expenditures.

In order to see how structural adjustment measures might affect food security, it is necessary to return to the analysis of food insecure groups given in table 3 and table 4: here the effect of six different policy measures is traced through on three main food insecure groups. It can be seen, for example, that increasing food imports, which here leads to a fall in food prices, is good for the urban poor but bad for small farmers who are food producers. The final effect will depend on the total numbers in these two groups.

Structural adjustment is often necessary and will have beneficial effects for poor people in the long run. Many authors have concluded, however, that structural adjustment will have a negative effect on food security in the short term. Thus, a paper for the European Community concludes that 'adjustment hurts the vulnerable, because they are the least able to adapt' (Kennes, 1989). In the worst case, poor people may find that unemployment and food prices both rise and that the Government 'safety net' is simultaneously weakened through cuts in social service expenditure. The food system may also become temporarily more unstable if public sector marketing is cut back before the private trade is ready to fill the gap.

However, the food security of poor people can be protected in the structural adjustment process, by taking measures which target income and asset increases to the poor, ensure access to food for poor people and work to stabilize the food system. The measures include: priority to poor people in production and employment programmes, especially through the provision of assets; the creation of rural and urban 'safety nets' through employment and income protection programmes; the creation or maintenance of targeted consumer and food production subsidies; stabilization of food prices through support to private trade and scaled-down public sector grain marketing; and the protection of health and education budgets.

There is, of course, a strong overlap between these measures and those normally found in projects concerned with the Social Dimensions of Adjustment (SDA). The value of focusing on food security within the framework of food self-sufficiency, is that it provides an integrated approach to one of the key basic needs and provides a clear framework in which to link policies and programmes across sectors. It also provides a specially appropriate focus for food aid.

VIII. Role of Donors and UN Agencies in the Promotion of Food Security

Even though all these measures have not yielded the desired results, the countries have received technical and material assistance from donors and agencies in the UN system such as the USAID, the World Bank, the FAO, the ECA, the WFP, the IFAD, the UNDP and the AfDB. The vital domains of assistance include the amelioration of food security infrastructure notably storage structures and early warning systems; the improvement of research and extension services; the reduction of food losses; the reinforcement of inter-state co-operation; the financing of food security projects; the provision of food aid for the vulnerable groups; and the building-up of related

capabilities in such critical areas as the operation and management of stores and post-harvest technology.

In this respect, it may be appropriate to mention the food-loss-reduction project which the ECA and the FAO have jointly been executing in the region. Through this project, useful training seminars or workshops have been organized for member countries at sub-regional levels. The focus of these seminars or workshops has been on post-harvest technologies aimed at, *inter alia*, improving the design, construction and management of storage structures; the development of pest-resistant seed varieties; the selection and proper utilization of pesticides; the evolution of biological pest control techniques; the analysis of toxic residues on stored crops; the assessment of crop losses; and the formulation of pertinent food-loss-reduction programmes and policies. The FAO's Food Security Assistance Scheme and its early warning system providing timely information on crop harvest and current climatic conditions are also worth mentioning.

The benefits of these assistance measures have reached the countries not only directly, but also through inter-governmental groupings such as the Inter-State Committee on Drought Control in the Sahel (CILSS); the Southern African Development Co-ordination Conference (SADCC); the Economic Community of West African States (ECOWAS); the Economic Community of the Great Lakes countries (CEPGL), and the ECA's Multinational Programming Centers (MULPOCs) operating in five sub-regions. These inter-governmental organizations have been instrumental in fostering inter-country co-operation in some aspects of food security like pest control including locusts and birds.

IX. Prospects for Food Security

The ineffectiveness of the countries' policy intervention measures; the continued decline of per capita food production; the rising population growth; and the expected decrease of food aid and its possible, negative impact on food availabilities do not augur well for the region's future food security. The relatively more favourable situation that prevailed in the 1960s and 1970s has not repeated itself in the 1980s and will not be repeated either in the 1990s. The energy content of the average diet in almost all African countries during the 1970s, weighted for the population, grew by about 0.4 per cent a year. This growth was associated with growth in per capita income of more than 2 per cent a year. But the growth of

per capita income in the 1980s has been far less than 2 per cent and this is likely to fall further down in the 1990s. Therefore, if the region's population continues to grow at the present rate, the number of people facing chronic food insecurity will increase. Given this bleak prognosis, the challenge for Africa is, therefore, to develop a truly "human faced" food security formula embedded in a rational utilization of food aid and an appropriate mix of policy options focusing primarily on the trade-offs between :

- (a) Sharply targeted and temporary interventions including agricultural food production subsidies and/or price supports programmes which may appear to have high delivery costs, but relatively lower budgetary costs and serve as appropriate incentive to food production and small farmers' income improvement;
- (b) General consumer subsidies, which are easier to implement and do distort producer prices and have high budgetary costs ;
- (c) Import subsidies, which are easy to implement, have low budgetary costs, and distort producer prices and, hence, may have large efficiency losses; and
- (d) Increased food aid, which helps to alleviate temporary food insecurity, but act as a disincentive to food production, change consumption habits and may have detrimental political and balance of payments consequences.

For the application of the policy instruments under (a), there is a need for the calculation of their costs and benefits to guide policy decision.

An analysis of the effectiveness of food production subsidy programmes as of other price intervention policies in Africa or elsewhere will depend on an assessment of the costs and benefits of such programmes. In making such assessment different fundamental questions should be asked including: (a) who benefits from the subsidies ?; (b) does the implementation of the subsidy result in a more equitable distribution of income ?; (c) what are the costs of the programme for the government ?; and (d) how efficient is the resource allocation ?. It is clearly not easy to provide answers to the above questions for different reasons including the difficulty of data collection. The formulae in Annex I provides a useful basis for calculating the effect and size of an input subsidy³. Whatever the results of the calculation, social valuation of food production

3 Barker, R. and Hayami, Y. Price support versus input subsidy for self-sufficiency in developing countries. *Am. Jnl. Agricult. Econom.* 58. pp. 617-658.

may differ from its opportunity cost and amply justify the temporary use of production subsidies to accelerate food self-sufficiency objective.

One has to recognize that agricultural prices, both in world and domestic markets, are heavily distorted at present. Reforms in agricultural support policies in the developed market economies, in the planning mechanism in "centrally planned economies", and in pricing and exchange rate policies in developing countries, could mean important and significant changes in relative prices during the present decade. It would, therefore, not be easy, though important, to project the appropriate balance in meeting food needs between domestic production and imports.

X. The Comparative Advantage Issue

It has often been argued that African countries have a comparative advantage on many of exported products. Consequently, it should continue to export what it produces "best" and import food ! Although there may still remain some truth on this argument as far as few products are concerned, the new generation of bio-technology is making the debate obsolete.

In fact, to cite only few, cocoa butter is presently being produced in laboratories, the same is true for coffee flavor, vanilla flavor, sugar substitute. Cocoa beans are already coming out of laboratories; with the cloning system, one leaf of palm tree can produce 50,000 palm trees per year; the artificial insemination can produce up to 20 calves per year from the same cow ! At the base of comparative advantage is the notion that a country will tend to export that commodity whose relative or comparative cost is lower than in other countries. With Africa completely at the margin of bio-technology, the question is: where is the comparative advantage ? Presently, anything can be produced anywhere, the only constraint is the cost.

It has been suggested that observed trade patterns be used to measure the real pattern of comparative advantage. Unfortunately, notwithstanding the above, the distortion of actual prices by government intervention in various forms, make the relationship between actual trade data and comparative advantage, rather tenuous. Consequently, efforts have been made to quantify comparative advantage based on existing data. These measures are "revealed", but not completely accurate, estimates of actual comparative advantage because, as seen above, the assumption that commodity trade patterns reflect intercountry differences in relative costs is an oversimplification of actual reality. This is the reason why it is suggested to consider the "Revealed Comparative Advantage, (RCA)" as an indicator of revealed competitive rather than comparative advantage.

The RCA concept rests on the assumption that a country's imports indicate which of its production activities are uncompetitive, whereas a country's exports indicate the sectors which are competitive in international terms.

The international competitiveness of any production sector is assessed by comparing the export-import relationship for that sector with the export-import relationship for the whole economy. Sectors in which the growth in exports exceeds the growth in imports (relative to the country's overall export and import performance) are assumed to avail of factors such as a relative abundance of capital or "skilled" labour, which are a source of comparative advantage in international trade.

For a given sector i , the RCA values may be defined as:

$$RCA = \frac{X_i / M_i}{\frac{\sum_1 X_i}{\sum_1 M_i}}$$

where X_i are exports in sector i and M_i are imports in sector i . $\sum_1 X_i$ and $\sum_1 M_i$ are total exports and total imports for the whole economy.

Some authors such as Vollrath prefer a relative export share measure of comparative advantage on the grounds that the composition of imports is greatly affected by protectionism while the composition of exports embodies comparatively few distortions and is therefore, more consistent with the real pattern of comparative advantage. The export share measure of revealed comparative advantage entails dividing the share of country j 's exports in world trade of good i by the country's share of the total world trade.

$$N_i = \frac{(X_i / W_i)}{(\sum_1 X_i / Z)}$$

where i is a good, X_i is the country's exports of good i , W_i is the total world trade in good i , $\sum_1 X_i$ is the country's total exports and Z the total world trade.

One should not lose sight that whatever the results based on such calculations, they are distorted by the consequences of government intervention and exchange rate volatility or variability and do not believe that they can be used in indicating what a country should do in the future.

A more economically relevant RCA could be defined as the difference between good's relative export share and its relative import share. A coefficient greater than zero indicates a

competitive advantage for the good i , a coefficient less than zero indicates a competitive disadvantage.

The new RCA is defined as follows:

$$RCA_i = RCS_i - RCD_i$$

where

$$RCS_i = (X_i / W_i) / (\sum_i X_i / Z)$$

$$RCD_i = (M_i / W_i) / (\sum_i M_i / Z)$$

and X and $\sum_i X_i$ and M and $\sum_i M_i$ are exports and total exports, and imports and total imports, respectively. Because of the tenuous connection between the RCA measure and comparative advantage, Vollrath calls it the Revealed Competitive Advantage.

It is quite possible to project the newly defined RCA values for exporters and importers of a given good. This could be done in applying linear regression coefficient weights. The tables in Annex II give the RCA for African countries from 1966 to 1987 for their food sector. The tables show clearly how rapidly the RCA for food production in Africa has deteriorated since independence in the 60's. Although some countries and some sub-regions are still well endowed and have a strong RCA, the continent, as a whole, has a decreasing negative RCA. This points to the urgent necessity of enhancing economic cooperation and integration among African countries in order to achieve the goal of food self-sufficiency at regional and sub-regional level.

One could conclude by stating that, RCA is a useful tool for positivistic research into changing trends in trade competitiveness. The extent of government intervention in both agricultural production and trade, together with the variability of exchange rates in recent years, make it difficult to use it to draw normative conclusions about what a country ought to be producing. There are other important considerations to justify why Africa should increase its food production and food self-sufficiency, despite all the economic calculations to justify the contrary.

XI. Food self-sufficiency

We, therefore, opt for food security only within the framework of food self-sufficiency but at the Continental level and not at the country's level. Three issues could be raised in this context:

- (a) whether it makes economic sense for the majority of African countries to aim at increasing their food self-sufficiency;
- (b) are there particular arguments that come into play in the case of the poorest African countries which are not necessarily applicable ?
- (c) will increase food self-sufficiency contribute to the improved availability, stability and access by the African poor to food supplies ?

It is clear that answering the first of these questions involves assessing the profitability of additional food production in African countries when all inputs and outputs are measured in opportunity cost prices. For well known reasons, opportunity cost prices for traded outputs and inputs are often defined as border prices while opportunity cost prices for factors of production represent their value in their best alternative use. Although they may be hard to apply in practice and are demanding of data, methodologies exist which can be used to determine the economic profitability of additional food production defined as above. For the above reason, economists often rely on protection coefficients as proxies to measure the degree of distortion between current market prices which farmers face and opportunity cost prices. Where these measures indicate a bias against food production, the tentative conclusion is often drawn that further expansion of food production is indeed economically desirable. Measuring the profitability of food production in either an absolute or relative sense, choosing the appropriate border price to use to measure the economic value of additional food output can be a difficult exercise.

Further, there may be reasons why the social valuation of food production may differ from its opportunity cost as defined above. Either because of external effects (benefits or costs) not taken into account in a purely market-based valuation, or for income distribution reasons governments may wish to place different valuation (social value) to a market-based one (such as border prices) on additional food production. If the social valuation is a higher one, it would suggest that government incentives should be positively biased in favour of food production, and not merely neutral, and that a further increase in food self-sufficiency would be desirable.

Apart from price distortions, there are reasons to believe that the allocation of non priced inputs (such as agricultural research, infrastructural investment, extension service, ... etc.) may have discriminated against food production in the past in Africa. Furthermore, market imperfections exist which means that actual food production has been below the economic optimum since the 1960s'.

Both arguments would indicate that increased food production and food self-sufficiency would be economically justified for the continent in the future.

The overall objective therefore for food production policy in Africa is not to ask whether African countries should pursue policies to increase their food self-sufficiency, but whether there are economic reasons for why they should do so.

Traditional patterns of trade in food stuffs (cereals, meats, dairy products, sugar, oil and oilseeds, ... etc) underwent considerable changes during the 1970s as self-sufficiency rates (SSRs) in many, if not all, African countries fell while self-sufficiency rates in most developed countries rose. Some traditional developed countries, net importers, emerged as sizeable net exporters to the world market.

We know that in the real world, the relationship between increased food production and food self-sufficiency is more complex and not necessarily on a one-to-one basis. However, the simplifying assumption that increasing food production will lead to increased food self-sufficiency allows to concentrate on the economic and social profitability of increased food production (without worrying too much about what is happening to demand).

XII. Conclusion

There are different reasons why one should assume that raising food self-sufficiency will continue to be valid for African continent even with continuing weakness in world market prices:

- (a) A high level of self-sufficiency in basic foods is widely held to be an objective transcending purely economic considerations and many countries would wish to pursue it even if it would be more economic (at the prevailing nominal rates of exchange and structure of protection) to resort to food imports.
- (b) It is widely considered that prices of cereals in world markets will generally remain weak over the medium term. These prices are closely linked, however, to the domestic policies of the main developed-country exporters which are subject to change, particularly in the light of global structural disequilibrium between supply and

demand, and the new world political and economic configuration shaping. Consideration of the alternative of producing or of importing additional cereals, for example, must incorporate assessments of risk and uncertainty.

- (c) Thirdly, there is also an overwhelming economic reason why pursuit of domestic production even at nominal cost which, at prevailing rate of exchange and structure of protection, are above those of world market prices, may be a sensible course of action. This is because in African countries, as is the case in many developing countries, protection from imports is much higher for industrial than for agricultural goods, often implying negative real rates of protection for agriculture. Such situation obviously favours imports of food and discourages production. Assuming that such discrimination against agriculture were attenuated, the economic advantages of importing would shift from food towards industrial products, therefore favouring domestic food production and increased self-sufficiency.

There are other reasons why we believe Africa should increase its food production in order to foster the LPA, the UN-PAAERD, UN-NADAF and the AAF-SAP objective of attaining Food-Self-Sufficiency.

- (a) The concept of the border price which is used to discourage Africa from producing food in Africa is not appropriate and its projection cannot be used to decide against domestic production alternatives of food⁴. Furthermore, present world food prices are depressed by the protectionist policies of developed countries. Such external price effect is not always taken into account in calculating the border prices or the protection coefficients. The question is whether African countries should distort their domestic food prices away from the international price simply because this price is influenced by the policies of their countries? We know that "conventional theory" would state that this consideration is not relevant, because international prices, however distorted, represent a transformation frontier available to the domestic economy to trade with and thereby reap the potential economic gains. National policies and mercantilist practice, however,

4 The relative lack of success of World Bank Commodity Price Projections is a testimony of how hazardous the exercise of projecting the trend in world market prices can be (Case of Malawi).

will find this a very hard argument to swallow; no developed country does apply the conventional theory, especially in the agricultural food sector, African countries have no reason to do so either at least, at this stage of their development process.

- (b) The allocation of the non-marketed inputs so vital to increased production could be and are of greater importance than the allocation of marketed inputs (such as fertilizers, water and pesticides). Included in this category are agricultural research, extension and investment in rural infrastructure, marketing infrastructures feeder roads, ... etc.). Much evidence has now been accumulated to show, not only that African countries (as well as other developing countries) tend to underinvest in these inputs, but that food production is particularly neglected. This situation also points to the necessity of increasing agricultural food-self sufficiency.
- (c) Even when all inputs, outputs and factors of production are priced at their opportunity costs, market imperfections may put food production below the economically optimal level. Conventional theory states that an input should be used up to the point where its price just equals its Marginal Value Product (MVP). In the case of fertilizer, there are other reasons why there may be a considerable discrepancy between its price and its MVP, including limited financial resources (imperfect credit markets) and lack of knowledge of its use (imperfect information markets). The first best solution would be to tackle these problems directly. Government might also wish deliberately to raise food prices above border levels in order to provide sufficient incentive to bring about the economically optimal volume of production. Which ever approach is used, the fact remains that the removal of either the constraints themselves or their symptom (reduced food output) should lead to greater food production and food self-sufficiency than the mere correction of price distortions alone. In Africa (as in developing countries in general) foreign exchange and labour markets are frequently (if not permanently) out of "equilibrium" and market prices (i.e. the prices farmers are actually paid) do not reflect the appropriate opportunity cost. Under such type of market imperfection, government intervention for the expansion of agricultural food production is amply justified on balance of payments and unemployment grounds⁵.

- (d) There are also externalities and social preferences which plead in favour of placing a higher valuation on increasing domestic agricultural food production than its border price alone. There may be cases where clear cut externalities (benefits or costs to society at large which are not reflected in the opportunity cost price of food output) do exist. For example: greater domestic food production is associated with greater food security at the national level (an insurance benefit); greater domestic food production is associated with an improved environment (an environmental benefit); or greater domestic food production is associated with more rapid growth in non farm sector (a linkage benefit). Income distribution is a social preference which has traditionally been a major motive behind developed countries government intervention in food pricing. The problem perceived in this policy is that of a gap between farm incomes, on the one hand, and non farm incomes, on the other. In African countries where those engaged in agriculture invariably make up the majority of the population, the main motive for government intervention in food pricing is even more justified by the desire or necessity to influence the inter-farm distribution of income, especially since there is a strong dichotomy between food production by small paysan farms (including women) and cash crop production by larger more commercial farms. Also, in case there is an association between food production and better nutrition at the household level, a higher valuation on food production than would be warranted on efficiency considerations alone, could be the result of the government desire to improve nutrition.
- (e) We have learned in standard economic theory that, if based on opportunity cost pricing of products and factors of production, the exploitation of comparative advantage in the short run would maximize the investible surplus and provide a necessary condition for maximizing long run growth. There are, however, linkages between different sectors. Assuming that two sectors have different linkages with the remainder of the economy, a government may then decide to stimulate the sector with the greater linkages because of its growth inducing effects in the rest of the economy.

Considering that the above argument is valid and accepted in theory, then it is just an empirical question whether domestic food production has stronger linkages with the rest of

5 For example, if the market price of labour is higher than its opportunity cost, then domestic food production will be lower than its economically optimal level. Policy distortions to favour agricultural food production could again be justified in this case.

the economy than other sectors candidates for government support. We can define various types of linkages: employment linkages, forward linkages, backward linkages, fiscal linkages,

consumption linkages, ... certain dynamic linkages such as the creation or transfer of management skills, technology, human capital or social overhead capital, ...etc.

**Table 1- Revealed Competitive Advantage of Africa, 1966-1787
1966**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCSi	RCDi	RCAi
North Africa (6)	2578.3	811.3	3006	3061	3.24	4.84	1.56	3.34
Algeria	194.4	181.2	621	639	1.10	1.77	1.60	0.17
Egypt	91.4	307.7	604	1070	0.53	0.85	1.62	-0.77
Libya	1.2	63.3	1010	405	0.01	0.01	0.88	-0.87
Morocco	214.0	154.9	428	476	1.54	2.82	1.84	0.98
Sudan	82.5	51.5	203	222	1.75	2.29	1.31	0.98
Tunisia	68.8	52.7	140	249	2.32	2.77	1.19	1.58
Central Africa (7)	154.6	56.2	379	377	2.74	2.30	0.84	1.46
Cameroun	93.4	16.3	145	146	5.77	3.64	0.63	3.01
Chad	9.7	8.8	24	30	1.38	2.28	1.66	0.62
CAR	10.4	6.4	31	31	1.64	1.89	1.17	0.72
Congo	7.9	11.3	43	70	1.14	1.04	0.91	0.13
Eq. Guinea	25.0	0.1	30	28	2.33	4.70	0.02	4.68
Gabon	2.2	11.2	100	66	0.13	0.12	0.96	-0.84
Sao Tome & Princ.	6.0	2.1	6	6	2.86	5.64	1.98	3.66
Great Lakes (3)	71.5	76.1	487	384	0.74	0.83	1.12	0.29
Burundi	8.5	3.4	10	20	5.00	4.80	0.96	3.84
Rwanda	7.3	2.0	12	21	6.39	3.43	0.54	2.89
Zaire	55.7	70.7	465.0	343	0.58	0.68	1.16	-0.48
West Africa (16)	1045.1	472.1	2002	2029	2.24	2.95	1.31	1.64
Benin	7.6	10.8	11	34	2.18	3.90	1.79	2.11
Burkina Faso	13.5	13.3	16	38	2.41	4.76	1.98	2.78
Cape Verde	0.5	2.7	1	9	1.67	2.82	1.69	1.13
Côte d'Ivoire	214.8	65.9	311	257	2.69	3.90	1.45	2.45
Gambia	11.9	3.4	16	18	3.94	4.20	1.07	3.13
Ghana	162.0	72.6	244	352	3.22	3.75	1.16	2.59
Guinea	19.3	10.1	58	70	2.31	1.88	0.81	1.07
Guinea Bissau	2.7	4.7	3	15	2.87	5.08	1.77	3.31
Liberia	8.0	22.8	150	112	0.26	0.30	1.15	-0.85
Mali	18.9	9.7	25	36	2.81	4.27	1.52	2.75
Mauritania	19.5	10.3	69	23	0.63	1.60	2.53	-0.93
Niger	40.1	7.1	35	45	7.26	6.47	0.89	5.58
Nigeria	364.4	125.7	795	718	2.62	2.59	0.99	1.60

Senegal	128.5	75.8	149	155	1.76	4.87	2.76	2.11
Sierra Leone	15.3	26.0	83	100	0.71	1.04	1.47	-0.43
Togo	18.1	11.2	36	47	2.11	2.84	1.35	1.49
Eastern & Southern Africa (19)								
	1036.8	380.4	2484	2373	2.60	2.36	0.90	1.46
Angola	145.8	38.9	221	207	3.51	3.72	1.06	2.66
Botswana	17.6	16.6	15	26	1.84	6.62	3.60	3.02
Comoros	2.0	2.0	4	7	1.75	2.82	1.61	1.21
Djibouti	-	3.3	26	28	0.00	0.00	0.67	-0.67
Ethiopia	90.1	12.6	111	162	10.44	4.58	0.44	4.14
Kenya	123.9	56.6	255	346	2.97	2.74	0.92	1.82
Lesotho	3.9	10.2	6	32	2.04	3.66	1.80	1.86
Madagascar	80.7	19.5	98	142	6.00	4.65	0.78	3.87
Malawi	41.8	14.8	49	76	4.38	4.82	1.10	3.72
Mauritius	68.8	28.0	71	70	2.42	5.47	2.26	3.21
Mozambique	66.5	34.8	112	208	3.55	3.35	0.94	2.41
Namibia	20.5	8.6	-	-	-	-	-	-
Seychelles	1.3	1.7	2	4	1.53	3.67	2.40	1.27
Somalia	30.8	13.1	30	42	2.10	5.79	1.76	4.03
Swaziland	20.0	6.0	54	34	3.28	2.09	1.00	1.09
Tanzania	110.2	30.6	260	237	4.27	2.39	0.73	1.66
Uganda	128.1	23.5	217	170	0.15	3.33	0.61	2.72
Zambia	10.6	34.2	691	345	2.64	0.09	0.56	-0.47
Zimbabwe	74.2	25.4	262	237	264.25	1.60	0.60	1.00
Total Africa (54)								
	4886.3	1796.1	8358	8224	2.68	3.30	1.23	2.07

World Food Trade, W_i (Export) = 36466.1 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 205830 Million US Dollars, FOB

**Table 1- Revealed Competitive Advantage of Africa, 1966-1987
1970**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCS _i	RCD _i	RCA _i
North Africa (6)	752.7	775.1	5105	3872	0.74	1.01	1.37	-0.36
Algeria	201.5	160.4	1009	1257	1.57	1.37	0.87	0.50
Egypt	162.0	189.1	762	787	0.88	1.45	1.64	-0.19
Libya	0.2	124.3	2366	554	0.00	0.00	1.54	-1.54
Morocco	254.2	151.8	488	684	2.35	3.56	1.52	2.04
Sudan	79.9	64.4	298	284	1.18	1.83	1.55	0.28
Tunisia	54.9	85.1	182	306	1.08	2.06	1.90	0.16
Central Africa (7)	212.5	83.5	484	507	2.67	3.00	1.13	1.87
Cameroun	142.6	33.1	232	242	4.49	4.21	0.94	3.27
Chad	12.7	12.8	36	61	1.68	2.41	1.44	0.97
CAR	10.4	8.5	31	34	1.34	2.30	1.71	0.59
Congo	13.5	12.8	31	57	1.94	2.98	1.54	1.44
Eq. Guinea	23.2	0.2	25	24	111.36	6.35	0.06	6.29
Gabon	2.1	12.8	121	80	0.11	0.12	1.09	-0.97
Sao Tome & Princ.	8.0	3.3	8	9	2.73	6.84	2.51	4.33
Great Lakes (3)	126.8	86.4	829	584	1.03	1.05	1.01	0.04
Burundi	21.2	3.8	24	22	5.11	6.04	1.18	4.86
Rwanda	15.2	4.2	24	29	4.37	4.33	0.99	3.34
Zaire	90.4	78.4	781	533	0.79	0.79	1.01	-0.22
West Africa (16)	1381.8	530.2	2978	2772	2.43	3.17	1.31	1.86
Benin	22.2	11.4	33	64	3.78	4.60	1.22	3.38
Burkina Faso	15.2	11.8	18	49	3.51	5.78	1.65	4.13
Cape Verde	1.3	6.3	2	16	1.65	4.45	2.69	1.76
Cote d'Ivoire	322.3	84.2	469	388	3.17	4.70	1.48	3.22
Gambia	15.4	5.5	17	18	2.96	6.20	2.09	4.11
Ghana	330.8	86.1	458	411	3.45	4.94	1.43	3.51
Guinea	20.5	9.2	42	55	2.92	3.34	1.14	2.20
Guinea Bissau	2.9	8.4	4	27	2.33	4.96	2.13	2.83
Liberia	8.2	26.1	213	150	0.22	0.26	1.19	-0.93
Mali	34.9	15.6	54	47	1.95	4.42	2.27	2.15
Mauritania	24.7	13.6	89	56	1.14	1.90	1.66	0.24
Niger	49.1	8.6	32	58	10.35	10.50	1.01	9.49
Nigeria	384.1	126.0	1239	1059	2.61	2.12	0.81	1.31
Senegal	95.3	69.9	152	193	1.73	4.29	2.48	1.81
Sierra Leone	18.2	32.8	101	116	0.64	1.23	1.93	-0.70
Togo	36.6	14.7	55	65	2.94	4.55	1.55	3.00

Eastern & Southern Africa (19)	1995	1996	1997	1998	1999	2000	2001	2002
Angola	189.4	57.8	423	369	2.86	3.06	1.07	1.99
Botswana	15.8	18.9	22	49	1.86	4.91	2.64	2.27
Comoros	3.1	2.7	5	9	2.07	4.24	2.05	2.19
Djibouti	-	6.6	21	49	0.00	0.00	0.92	-0.92
Ethiopia	100.6	14.5	122	172	9.78	5.64	0.58	5.06
Kenya	155.6	47.7	305	442	4.73	3.49	0.74	2.75
Lesotho	4.2	11.8	6	32	1.90	4.79	2.52	2.27
Madagascar	110.7	21.3	145	170	6.09	5.22	0.86	4.36
Malawi	47.1	17.0	60	86	3.97	5.37	1.35	4.02
Mauritius	66.0	27.0	69	76	2.69	6.44	2.43	4.01
Mozambique	91.0	42.9	156	324	4.41	3.99	0.91	3.08
Namibia	34.4	8.0	-	-	-	-	-	-
Seychelles	1.6	2.9	2	10	2.76	5.47	1.98	3.49
Somalia	26.7	15.1	31	45	2.57	5.89	2.30	3.59
Swaziland	29.2	9.9	71	60	2.49	5.81	1.13	1.68
Tanzania	127.8	31.7	259	318	4.95	3.38	0.68	2.70
Uganda	180.0	20.8	282	172	5.28	4.37	0.83	3.54
Zambia	5.8	51.5	1001	477	0.05	0.04	0.74	-0.70
Zimbabwe	106.7	12.2	367	329	7.84	1.99	0.25	1.74
Total Africa (5)	3769.4	1896.5	12743	10924	1.70	2.02	1.19	0.83

World Food Trade, W1 (Export) = 46145.7 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 315706 Million US Dollars, FOB

**Table 1 - Revealed Competitive Advantage of Africa, 1966-1987
1975**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCSi	RCDi	RCAi
North Africa (6)	1147.1	4498.3	15852	18500	0.30	0.55	1.85	-1.30
Algeria	174.5	1301.7	4699	5999	0.17	0.28	1.65	-1.37
Egypt	243.0	1383.3	1402	3934	0.49	1.32	2.68	-1.36
Libya	0.1	606.6	6840	3542	0.00	0.00	1.30	-1.30
Morocco	386.2	761.7	1617	2568	0.81	1.82	2.26	-0.44
Sudan	178.2	178.8	438	1033	2.35	3.10	1.32	1.78
Tunisia	165.1	266.2	856	1424	1.03	1.47	1.42	0.05
Central Africa (7)	387.3	212.1	1721	1473	1.56	1.71	1.10	0.61
Cameroun	300.3	69.3	448	599	5.79	5.10	0.88	4.22
Chad	28.9	27.7	68	133	2.04	3.24	1.59	1.65
CAR	15.6	18.9	48	69	1.19	2.47	2.09	0.38
Congo	10.7	33.3	179	170	0.31	0.46	1.49	-1.03
Eq. Guinea	20.6	1.0	26	20	15.85	6.03	0.38	5.65
Gabon	2.5	58.5	942	471	0.02	0.02	0.95	-0.93
Sao Tome & Princ.	8.9	3.4	10	11	2.88	6.78	2.35	4.43
Great Lakes (3)	223.7	228.0	939	1065	1.11	1.31	1.63	0.18
Burundi	30.2	11.1	32	62	5.27	7.19	1.36	5.83
Rwanda	36.8	29.1	42	96	2.89	6.67	2.31	4.36
Zaire	156.7	187.8	865	905	0.87	1.38	1.58	-0.20
West Africa (16)	2292.8	1497.6	11710	10338	1.35	1.49	1.10	0.39
Benin	16.3	44.1	32	197	2.28	3.88	1.70	2.18
Burkina Faso	32.6	31.9	44	151	3.51	5.64	1.61	4.03
Cape Verde	0.7	19.4	2	40	0.72	2.67	3.69	-1.02
Cote d'Ivoire	739.1	202.1	1182	1127	3.49	4.76	1.37	3.39
Gambia	48.7	11.8	48	60	5.16	7.73	1.50	6.23
Ghana	564.9	105.8	807	791	5.23	5.33	1.02	4.31
Guinea	18.8	32.4	143	165	0.67	1.00	1.50	-0.50
Guinea Bissau	5.5	14.4	7	37	2.02	5.98	2.96	3.02
Liberia	14.5	47.2	394	332	0.26	0.28	1.08	0.80
Mali	46.2	76.0	85	177	1.27	4.14	3.27	0.87
Mauritania	34.0	60.2	174	177	0.57	1.49	2.59	-1.10
Niger	28.7	27.9	91	101	1.14	2.40	2.10	0.30
Nigeria	417.4	605.7	7994	6041	0.52	0.40	0.76	-0.36

Senegal	262.0	153.3	460	583	2.17	4.34	2.00	2.34
Sierra Leone	28.8	40.7	121	185	1.08	1.81	1.68	0.13
Togo	34.6	24.7	126	174	1.93	2.09	1.08	1.01
Eastern & Southern Africa (19)								
	2419.2	887.9	5693	6792	3.25	3.24	1.00	221.00
Angola	195.3	66.5	1012	429	1.25	1.47	1.18	0.29
Botswana	55.5	34.1	142	218	2.50	2.98	1.19	1.79
Comoros	6.5	5.7	10	23	2.62	4.95	1.89	3.06
Djibouti	-	19.2	36	147	0.00	0.00	0.99	-0.99
Ethiopia	176.6	25.9	240	296	8.41	5.60	0.67	4.93
Kenya	242.0	68.7	644	980	5.36	2.86	0.53	2.33
Lesotho	4.8	42.5	13	160	1.39	2.81	2.02	0.79
Madagascar	227.2	52.3	294	367	5.42	5.88	1.09	4.79
Malawi	120.6	23.8	139	251	9.15	6.61	0.72	5.89
Mauritius	260.6	88.4	298	332	3.28	6.66	2.03	4.63
Mozambique	120.5	81.6	202	417	3.04	4.53	1.49	3.04
Namibia	36.5	13.3	-	101	-	-	1.00	-1.00
Seychelles	2.0	9.4	6	32	1.13	2.54	2.24	0.30
Somalia	80.7	64.9	89	155	2.17	6.90	3.19	3.71
Swaziland	103.2	20.7	196	180	4.58	4.01	0.88	3.13
Tanzania	199.9	152.0	372	773	2.73	4.09	1.50	2.59
Uganda	227.0	16.9	267	200	10.06	6.47	0.64	5.83
Zambia	11.3	71.0	810	929	0.18	0.11	0.58	-0.47
Zimbabwe	349.3	31.0	923	802	9.79	2.88	0.29	2.59
Total Africa (51)								
	5475.4	7045.9	38913	58166	0.97	1.87	1.12	0.13

World Food Trade, W_i (Export) = 115752.9 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 881371 Million US Dollars, FOB

**Table 1 - Revealed Competitive Advantage of Africa, 1966-1987
1980**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCSI	RCDi	RCAi
North Africa (6)	1839.0	7593.3	31465	45764	0.13	0.29	2.20	-1.91
Algeria	120.3	2201.9	10544	15618	0.04	0.07	1.90	-1.83
Egypt	206.6	2347.8	4860	3046	0.14	0.62	4.40	-3.78
Libya	-	1314.8	6777	21919	0.00	0.00	0.00	0.00
Morocco	695.6	852.4	4185	2403	1.42	2.64	1.86	0.78
Sudan	257.0	394.4	1576	543	1.89	4.31	2.28	2.03
Tunisia	159.5	482.0	3527	2235	0.52	0.65	1.25	-0.60
Central Africa (7)	809.7	390.7	3021	4765	1.31	1.65	1.18	0.37
Cameroun	637.9	145.9	1602	1384	5.06	4.20	0.83	3.37
Chad	75.7	5.6	74	146	6.85	4.72	0.69	4.03
CAR	36.9	23.6	81	115	1.10	2.92	2.65	0.27
Congo	14.6	81.9	545	911	0.11	0.15	1.37	-1.22
Eq. Guinea	11.9	9.6	26	14	2.30	7.74	3.36	4.38
Gabon	14.2	117.3	674	2173	0.04	0.06	1.59	-1.53
Sao Tome & Princ.	18.5	6.8	19	22	2.35	7.66	3.26	4.40
East Africa (3)	413.4	222.0	1289	1816	0.92	1.87	1.81	-0.04
Burundi	60.4	28.5	168	65	5.48	8.47	1.55	6.92
Rwanda	57.6	39.7	243	112	3.15	4.69	1.49	3.20
Zaire	195.4	153.8	842	1639	0.65	1.09	1.66	-0.57
West Africa (18)	2811.9	4136.2	24254	22662	0.71	1.17	1.58	-0.44
Benin	43.0	84.1	331	63	2.69	6.22	2.31	3.91
Burkina Faso	36.8	73.2	358	90	2.00	3.73	1.86	1.87
Cape Verde	3.3	29.3	68	4	1.91	7.52	3.93	3.59
Cote d'Ivoire	1955.3	357.0	3015	3142	5.26	5.67	1.08	4.59
Gambia	32.6	38.7	163	31	4.42	9.58	2.16	7.42
Ghana	788.6	160.9	1129	1148	4.82	6.26	1.30	4.96
Guinea	33.1	73.9	270	390	0.31	0.77	2.49	-1.72
Guinea Bissau	9.2	12.5	55	11	3.68	7.62	2.07	5.55
Liberia	50.8	104.7	534	589	0.44	0.79	1.79	-1.00
Mali	113.1	75.2	440	205	3.23	5.03	1.56	3.47
Mauritania	46.4	90.2	286	194	0.76	2.18	2.87	-0.69
Niger	82.1	81.8	594	580	1.03	1.29	1.25	0.04
Nigeria	424.4	2487.2	15025	24999	0.10	0.15	1.51	-1.36

Senegal	204.9	280.9	1052	477	1.61	3.91	2.43	1.48
Sierra Leone	59.4	95.8	414	204	1.26	2.65	2.11	0.54
Togo	68.9	90.8	550	335	1.25	1.87	1.50	0.37
Angola	169.6	373.2	1341	1902	0.32	0.81	2.54	-1.73
Botswana	40.5	94.5	691	503	0.59	0.73	1.25	-0.52
Comoros	7.3	11.9	33	20	1.01	3.33	3.29	0.04
Djibouti	2.6	64.1	125	19	0.27	1.25	4.67	-3.42
Ethiopia	314.8	97.5	722	425	5.49	6.75	1.23	5.52
Kenya	590.8	203.0	2588	1389	5.42	3.88	0.71	3.17
Lesotho	6.2	115.0	464	58	0.43	0.97	2.26	-1.29
Madagascar	335.4	70.2	600	402	7.13	7.60	1.07	6.53
Malawi	247.1	32.5	440	285	11.74	7.90	0.67	7.23
Mauritius	307.4	162.1	619	431	2.72	6.50	2.39	4.11
Mozambique	164.8	121.1	800	281	3.87	5.34	1.38	3.96
Namibia	55.0	22.6						
Seychelles	4.7	20.7	99	21	1.07	2.04	1.91	0.13
Somalia	115.0	136.4	348	133	2.21	7.88	3.57	4.31
Swaziland	203.6	38.1	538	369	7.79	5.03	0.65	4.38
Tanzania	320.2	162.0	1226	508	4.77	5.74	1.20	4.54
Uganda	340.0	44.9	293	345	6.43	8.98	1.40	7.58
Zambia	5.0	141.5	1111	1299	0.03	0.04	1.16	-1.12
Zimbabwe	353.6	58.3	1290	1423	5.50	2.26	0.41	1.85

World Food Trade, W1 (Export) = 219731.7 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 2001999 Million US Dollars, FOB

**Table 1 - Revealed Competitive Advantage of Africa, 1966-1987
1985**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCSI	RCDI	RCAI
Algeria	56.0	2412.7	10149	9841	0.02	0.05	2.37	-2.31
Egypt	221.3	3779.8	3714	9962	0.16	0.58	3.67	-3.09
Libya	-	1078.5	10841	5422	-	-	-	-
Morocco	559.0	686.7	2165	3849	1.45	2.50	1.73	+0.77
Sudan	151.6	362.3	367	757	0.86	4.00	4.63	-0.63
Tunisia	167.5	385.8	1627	2597	0.69	1.00	1.44	-0.44
Central Africa (7)	620.2	465.1	4090	3654	1.00	1.00	1.00	-0.15
Cameroun	435.4	148.5	722	1151	4.67	5.84	1.25	4.59
Chad	86.9	35.9	180	190	2.56	4.67	1.83	2.84
CAR	39.8	21.2	88	109	2.33	4.38	1.88	2.50
Congo	18.3	113.0	1087	598	0.09	0.16	1.84	-1.68
Eq. Guinea	19.5	6.4	25	27	3.29	7.55	2.29	5.26
Gabon	13.0	135.0	1974	976	0.05	0.06	1.34	-1.28
Sao Tome & Princ.	7.3	4.5	14	13	1.51	5.05	3.35	1.70
East Africa (5)	367.3	355.0	1193	477	1.25	2.22	2.33	0.66
Burundi	100.4	32.6	111	186	5.16	8.75	1.70	7.05
Rwanda	68.7	62.3	131	294	2.47	5.07	2.05	3.02
Zaire	198.2	260.1	947	997	0.80	2.03	2.52	-0.49
West Africa (16)	3605.9	2887.0	19540	12834	0.82	1.79	2.18	-0.39
Benin	51.1	85.7	110	595	3.23	4.49	1.39	3.10
Burkina Faso	22.5	85.7	70	333	1.25	3.11	2.49	0.62
Cape Verde	3.1	24.3	4	81	2.58	7.50	2.90	4.60
Cote d'Ivoire	2064.3	395.1	2939	1742	3.10	6.80	2.19	4.61
Gambia	17.9	48.1	43	93	0.80	4.03	5.00	-0.97
Ghana	428.1	96.4	617	731	5.26	6.71	1.28	5.43
Guinea	17.9	56.9	480	420	0.28	0.36	1.31	-0.95
Guinea Bissau	11.3	15.1	12	60	3.74	9.11	2.44	6.67
Liberia	43.7	90.1	436	284	0.32	0.97	3.07	-2.10
Mali	88.0	89.5	172	457	2.61	4.95	1.89	3.06
Mauritania	162.0	116.1	374	234	0.87	4.19	4.80	-0.61
Niger	62.2	115.9	320	345	0.58	1.88	3.25	-1.37
Nigeria	290.1	1273.6	13113	6205	0.11	0.21	1.99	-1.78
Senegal	230.1	250.7	554	812	1.35	4.02	2.99	1.03
Sierra Leone	60.9	66.1	106	154	1.34	5.56	4.15	1.41

Togo	52.7	77.7	190	288	1.03	2.68	2.61	0.07
Eastern & Southern Africa (19)	9054.7	1826.1	7969	9440	1.98	3.71	1.87	1.84
Angola	73.5	362.7	2261	665	0.06	0.31	5.28	-4.97
Botswana	72.5	109.8	744	583	0.52	0.94	1.82	-0.88
Comoros	13.9	9.3	16	36	3.36	8.41	2.50	5.91
Djibouti	4.1	57.8	14	201	1.02	2.83	2.78	0.05
Ethiopia	246.4	296.3	333	996	2.49	7.16	2.88	4.28
Kenya	626.1	142.8	958	1437	6.58	6.32	0.96	5.36
Lesotho	4.8	118.1	23	363	0.64	2.02	3.15	-1.13
Madagascar	223.8	61.1	274	402	5.37	7.90	1.47	6.43
Malawi	224.1	21.5	253	287	11.82	8.57	0.72	7.85
Mauritius	215.8	106.2	435	529	2.47	4.80	1.94	2.86
Mozambique	65.2	119.4	77	377	2.67	8.19	3.06	5.13
Namibia	37.0	23.9	-	-	-	-	-	-
Seychelles	3.1	17.5	28	99	0.63	1.07	1.71	-0.64
Somalia	106.5	117.9	91	195	1.94	11.32	5.85	5.47
Swaziland	99.7	48.7	176	323	3.76	5.48	1.46	4.02
Tanzania	215.5	99.4	284	1031	7.87	7.34	0.93	6.41
Uganda	423.6	17.8	350	327	22.23	11.70	0.53	11.17
Zambia	10.8	52.6	543	692	0.26	0.19	0.74	-0.55
Zimbabwe	388.3	43.3	1109	897	7.25	3.39	0.47	2.92
Total Africa (54)	8863.3	14239.1	61651	59243	0.55	1.53	1.53	0.72

World Food Trade, W_i (Export) = 199363.6 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 1928999 Million US Dollars, FOB

**Table 1 - Revealed Competitive Advantage of Africa, 1966-1987
1987**

Country/Subregion	Food Export X_i	Food Import M_i	Total Export $\sum X_i$	Total Imports $\sum M_i$	RCA	RCS _i	RCD _i	RCA _i
North Africa (6)	1554.9	7841.8	24740	31998	0.26	0.64	2.50	-1.86
Algeria	29.1	1869.4	8186	7029	0.01	0.04	2.71	-2.67
Egypt	314.9	3613.4	4352	11941	0.24	0.74	3.09	-2.35
Libya		1116.7	6700	4877	0.00	0.00	2.34	-2.34
Morocco	759.3	632.6	2827	4230	1.80	2.74	1.53	1.21
Sudan	186.7	254.0	504	871	1.27	3.78	2.98	0.80
Tunisia	264.9	355.7	2171	3047	1.05	1.25	1.19	0.06
Central Africa (7)	548.1	521.1	5308	3486	1.11	1.69	1.53	0.16
Cameroun	408.2	242.5	829	1749	3.55	5.02	1.41	3.61
Chad	66.2	18.3	140	210	5.43	4.83	0.89	3.94
CAR	21.4	22.5	100	125	1.19	2.18	1.84	0.34
Congo	18.8	106.2	900	550	0.11	0.21	1.97	-1.76
Eq. Guinea	10.6	6.6	39	50	2.06	2.77	1.35	1.42
Gabon	16.9	119.7	1286	785	0.09	0.13	1.56	-1.43
Sao Tome & Princ.	6.0	5.3	14	17	1.37	1.21	1.00	0.21
Great Lakes (3)	360.1	303.5	1170	1321	1.34	3.14	2.24	0.80
Burundi	64.7	20.6	86	212	7.74	7.68	0.99	6.69
Rwanda	104.2	37.7	114	353	8.56	9.33	1.09	8.24
Zaire	191.2	245.2	970	756	0.61	2.01	3.31	-1.30
West Africa (18)	3552.7	2660.4	14510	11878	1.09	2.50	2.29	0.21
Benin	77.4	97.8	70	550	6.22	11.28	1.81	9.47
Burkina Faso	17.5	81.8	90	434	1.03	1.98	1.92	0.06
Cape Verde	3.6	36.5	5	124	2.45	7.35	3.00	4.35
Cote d'Ivoire	1853.3	525.1	3110	2369	2.69	6.08	2.26	3.82
Gambia	23.8	48.2	48	99	1.02	5.06	4.97	0.09
Ghana	519.0	119.3	909	919	4.40	5.83	1.32	4.51
Guinea	28.3	75.5	520	470	0.34	0.56	1.64	-1.08
Guinea Bissau	7.9	14.1	15	70	2.61	5.37	2.06	3.31
Liberia	20.3	82.0	382	308	0.20	0.54	2.72	-2.18
Mali	92.4	48.7	260	493	3.60	3.63	1.01	2.62
Mauritania	197.6	121.0	428	235	0.90	4.71	5.25	-0.54
Niger	65.5	76.5	350	370	0.91	1.91	2.11	-0.20
Nigeria	199.2	917.5	7365	3917	0.12	0.28	2.39	-2.11

Senegal	347.5	238.9	606	1023	2.46	5.85	10.23	-4.38
Sierra Leone	46.6	91.7	132	137	0.53	3.60	6.83	-3.23
Togo	52.8	85.8	220	360	1.01	2.45	2.43	0.02
Eastern & Southern Africa (19)								
Angola	24.0	283.7	1500	1120	0.06	0.16	2.58	-2.42
Botswana	47.3	104.9	1587	936	0.27	0.30	1.14	-0.84
Comoros	9.5	11.9	12	52	3.46	8.08	2.34	5.74
Djibouti	4.0	62.5	20	201	0.64	2.04	3.17	-1.13
Ethiopia	231.2	193.6	358	1102	3.68	6.59	1.79	4.80
Kenya	600.3	124.2	961	1756	8.83	6.37	0.72	5.65
Lesotho	0.8	107.9	40	420	0.08	0.20	2.62	2.42
Madagascar	264.2	48.2	332	302	4.99	8.12	1.63	6.49
Malawi	247.8	11.0	276	296	24.16	9.16	0.38	8.78
Mauritius	364.5	115.5	901	1013	3.55	4.13	1.16	2.97
Mozambique	65.3	157.3	100	660	2.74	6.66	2.43	4.23
Namibia	84.0	24.9	-	-	-	-	-	-
Seychelles	6.4	21.1	22	114	1.57	2.97	1.89	1.08
Somalia	85.2	113.6	90	190	1.58	9.66	6.10	3.56
Swaziland	155.4	58.1	311	416	3.58	5.10	1.43	3.67
Tanzania	244.9	88.1	282	928	9.15	8.86	0.97	7.89
Uganda	307.4	36.2	320	477	12.66	9.80	0.77	9.03
Zambia	25.9	36.2	873	739	0.61	0.30	0.50	-0.20
Zimbabwe	489.3	35.5	1419	1044	10.14	3.52	0.35	3.17
Total Africa (54)								
	8273.4	19569.3	53132	60447	3.75	1.72	2.23	0.73

Note:

$$RCA = \frac{X_i / M_i}{\sum X_i / \sum M_i} \quad RCS_i = \frac{X_i / W_i}{\sum X_i / Z}$$

$$RCD_i = \frac{M_i / W_i}{\sum M_i / Z} \quad RCA_i = RCS_i - RCD_i$$

RCA - Revealed Competitive Advantage

RCS - Revealed Competitive Supply

RCD - Revealed Competitive Demand

World Food Trade, W_i (Export) = 244413.4 Million US Dollars, FOB

Total Merchandise World Trade, Z (Export) = 2494100 Million US Dollars, FOB

Source: 1987, 1988 and 1989 UNCTAD Commodity Yearbooks, United Nations, New York.

ANNEX II

Costs and benefits of Subsidy and Price Support Programmes

The formulae for calculating the different parameters are as follows:

Level of Needed Input

The amount of input needed to produce a desired amount of product is:

$$X_s = X_{Ns} \left[1 + \left[\frac{Q_s - Q_{Ns}}{Q_{Ns}} \right] \right] \frac{1}{e_p}$$

Where

X_s = Amount of input needed to produce a desired amount of product

X_{Ns} = Amount of input purchased without subsidy

Q_{Ns} = Amount of product produced without subsidy

Q_s = Amount of product produced with elasticity

e_p = Production elasticity

The Desired Input price level

The subsidized input price necessary to induce farmers to purchase X_s , the amount of input needed to achieve a targeted production level is as follows:

$$P_s = P_{Ns} \left[\frac{X_s}{X_{Ns}} \right]^{-1/e_d}$$

where,

P_s = The input price needed to induce farmers to purchase a desired amount of input

P_{Ns} = Price of the input without subsidy

X_s = Amount of input purchased with subsidy

X_{Ns} = Amount of input purchased without subsidy

e_d = Price elasticity of input demand with respect to the product

Cost of the Input Subsidy Programme

The cost of the input subsidy programme to the government is the difference between what the government pays for the input (input costs) and

what it sells to the farmer (input revenue). This cost is calculated as follows:

$$GC = X_s [P_s - P_{Ns}]$$

where,

GC = Actual cost of the subsidy programme to the government

X_s = Amount of input purchased with subsidy

P_s = Price of input with subsidies

P_{Ns} = Price of input without subsidy

Reduction in Government Revenue

This is a measure of what the government would have to pay if it had to import the product in order to achieve some kind of security with respect to the product. It is calculated as follows:

$$GR = (P_D - P_w) (Q_s - Q_{Ns})$$

where,

GR = Reduction (or possibly increase) in government revenue resulting in a decrease in the import of the product

P_D = Domestic consumer price for the product

P_w = Import price for the product

Q_s = Amount of product produced with subsidies

Q_{Ns} = Amount of product produced without subsidies

Producers' benefits

Producers' benefits which represent the extra income that the farmers obtain as a result of the input subsidy is calculated as follows:

$$P_B = (P_{Ns} - P_s) X_{Ns} + (1 - M_p) (Q_{Ns} - Q_s) P_D - P_s (X_s - X_{Ns})$$

Where,

P_B = Producers' benefits

P_{Ns} = Price of input without subsidy

P_s = Price of input with subsidy

X_{Ns} = Amount of input purchased without subsidy

X_s = Amount of input purchased with subsidy

M_p = Ratio of unit processing and marketing cost to consumer price of product

Q_{Ns} = Amount of product produced without subsidy

Q_s = Amount of product produced with subsidy

P_D = Domestic consumer price for the product

Net Savings in Foreign Exchange

The net savings in foreign exchange indicates the saving achieved as a result of not importing the product. It is calculated as follows:

$$S = P_w (Q_s - Q_{Ns} - P_{Ns}) (1 - M_f) (X_s - X_{Ns})$$

Where,

S = Net savings of foreign exchange

P_w = Import price of the product

Q_{Ns} = Amount of the product produced without the subsidy

Q_s = Amount of the product produced with subsidy

P_{Ns} = Price of the input without subsidy

X_{Ns} = Amount of the input purchased without subsidy

X_s = Amount of the input purchased with subsidy

M_f = Ratio of unit marketing cost to the retail price of the input

The above estimates represent straight forward calculations of the costs and benefits that can be attributed to the application of any subsidy and/or price support programme. The usual procedure is to either compare two groups, one with subsidy and the other without or to do a comparison of the same group before and after the application of the subsidy programme. Since the items for which subsidies could be offered in Africa range from recurrent items such as seeds and fertilizers to capital goods such as irrigation equipment, and from tangible things such as increases in input use to intangible ones such as increased levels of employment, it is clear that the above formulae for calculating the benefits and costs of subsidies will fail to gauge the impact of a subsidy and/or price support programme in a precise manner.

Migrations Rurales, Co-développement Et Intégration Sociale En Afrique Noire-Les Expériences Camerounaises

by Dr. Paul Hengue¹

RESUME

Dans la plupart des contextes nationaux en Afrique, les migrations rurales sont essentiellement perçues comme un facteur de destabilisation des espaces économiques et sociaux. Cette perception négative provient en général d'une appréhension insuffisante des motivations (ou conditions fondamentales) qui sont en amont et en aval du processus migratoire et dont la maîtrise seule est susceptible d'en faire un facteur dynamique d'intégration sociale (thème si cher aux hommes politiques africains) et, partant, de développement durable au profit de toutes les communautés qui y sont impliquées.

Afin de cerner une telle problématique, cet article passe en revue des expériences variées et multiformes survenues dans un pays africain, le Cameroun - baptisé "Afrique en miniature" en raison de sa diversité exceptionnelle (première et deuxième partie). Ensuite, après avoir démontré les articulations qui existent entre la démographie, les phénomènes économiques et sociaux et l'environnement, ce papier conclut à la nécessité d'une politique migratoire adaptée au contexte spécifique de chaque région (troisième partie). Les mouvements migratoires sont en effet un facteur d'interdépendance entre les peuples ou groupes pour autant qu'ils sont maîtrisés et collectivement assumés. Au-delà de l'objectif théorique consistant à poser les bases d'une typologie des migrations, le but final de cet article est donc de montrer qu'en Afrique, les mouvements migratoires, à l'instar de certaines langues ou groupes ethniques qui se retrouvent à cheval sur plusieurs pays, sont des phénomènes positifs qui, sagement exploités, pourraient contribuer à

l'unité et à l'intégration du continent. Il suffirait pour cela d'abattre la plupart d'obstacles institutionnels qui, à la suite des frontières coloniales, consacrent encore le cloisonnement des masses rurales africaines.

INTRODUCTION

En Afrique noire, les migrations rurales sont un phénomène aussi ancien que les communautés humaines qui peuplent ce continent. Les traditions historiques révèlent que dans tous les contextes, à un moment donné ou à un autre, il y a toujours eu des transferts de populations d'un espace résidentiel à un autre. Suivant les circonstances, ces mouvements se sont opérés soit, de manière discrète, lente et progressive, soit de manière spontanée et massive, soit encore de manière organisée et canalisée en fonction d'objectifs définis au départ. Leurs causes ont toujours été multiples, liées aux besoins de survie humaine face aux perturbations naturelles, à l'intolérance des hommes ou alors à la recherche des aires nouvelles d'épanouissement hors du cadre traditionnel. Aucune typologie exhaustive pour l'Afrique n'a encore été faite. Mais dans tous les cas, le problème fondamental inhérent aux mouvements migratoires est de savoir dans quelles mesures ils contribuent au co-développement des peuples impliqués dans le processus et à quelles conditions ils peuvent contribuer à une intégration sociale stable et véritable. Les expériences accumulées en trois quarts de siècle au Cameroun, un pays de dimensions moyennes en Afrique Centrale, mais géographiquement et sociologiquement complexe, sont édifiantes à ce sujet.

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I. LE CONTEXTE GENERAL DES MIGRATIONS RURALES AU CAMEROUN : CONTRASTES ET DESEQUILIBRES FONDAMENTAUX

1. LE CONTEXTE GEOGRAPHIQUE, DEMOGRAPHIQUE ET SOCIO-CULTUREL

Le Cameroun est un pays fortement contrasté qui, dans divers domaines, apparaît comme un pont entre l'Afrique Centrale et l'Afrique Occidentale, entre l'Afrique humide et l'Afrique sèche, entre l'Afrique francophone et l'Afrique anglophone. Cette position transitoire au sein d'un vaste continent confère à ce pays de 475 000 km² et 12 millions d'habitants une singularité remarquable.

Géographiquement, c'est le pays de contrastes entre hauts plateaux et plaines basses, sols volcaniques ou alluviaux fertiles et formations granitiques stériles, forêts denses au Sud et savanes herbeuses ou steppe, en passant par les forêts-galeries et les savanes boisées. Le climat qui sous tend ces ensembles est un échelonnement complet de systèmes intertropicaux qui s'étire depuis le type guinéo-équatorial en zone côtière jusqu'au type soudano-sahélien dans la région septentrionale.

Les densités démographiques et les modes de vie des populations épousent ces contradictions fondamentales génératrices de déséquilibres et d'instabilité dont naissent les mouvements migratoires. Ainsi, des régions à très fortes densités de populations et d'habitat (150 à 350 hab/km² à l'Ouest sur les plateaux Bamiléké 70 à 100 hab/km² dans l'Extrême-Nord sur les Monts Mandara, 72 à 80 hab/km² dans le Département de la Lékié au Centre forestier) s'opposent à des régions peu ou pas peuplées : 0,5 à 7 hab/km² dans la forêt du Sud-Est, 5 à 7 hab/km² dans l'Adamaoua, les vallées de la Bénoué et du Logone en zone soudano-sahélienne.

Au niveau social et culturel, le pays compte plus d'une centaine d'ethnies, plus de deux cent langues traditionnelles et met en concurrence des variétés extrêmes de moeurs et d'usages coutumiers. L'espace des croyances est dominé par l'islam à 70 p.100 dans les provinces septentrionales et par le christianisme à 35 ou 40 p.100 dans les provinces méridionales. L'organisation sociale de base, le système de regroupement des populations, les traditions alimentaires et les régimes socio-politiques anciens changent énormément du Nord au Sud. Au Nord, à l'Ouest et dans le Nord-Ouest, l'espace social est organisé en chefferies et royaumes structurés et hiérarchisés. En zone forestière, la société demeure largement acéphale, malgré les vaines tentatives de l'Administration d'y organiser les chefferies sur le modèle des hauts plateaux, des savanes et du sahel. Administrativement, le pays

a été divisé en dix provinces de taille, de densité et de vocation très inégales.

Toutes ces caractéristiques géographiques, démographiques et socio-culturelles contrastées se transposent au plan de l'urbanisation par une inégale répartition des centres urbains, des vitesses de croissance et des niveaux de complexité des relations sociales à l'intérieur des villes continuellement alimentées par l'exode rural. Des distorsions irréversibles se sont introduites dans les rapports villes-campagnes avec des répercussions retentissantes sur toutes les structures de production. En 1976, le Cameroun comptait 28 villes de plus de 10 000 habitants. Dix ans plus tard en 1987, il en comptait 62 000. Le taux d'urbanisation du pays est passé régulièrement de 21,8 p.100 en 1964 à 28,4 p.100 en 1976 et à 37,8 p.100 en 1987. Un nombre important de villes connaissent depuis une quinzaine d'années des taux de croissance annuelle supérieurs à 7 ou 8 p.100. Ce processus destructurant pose au monde rural et urbain des problèmes dramatiques qui affectent l'environnement de la production dans son ensemble et menacent parfois même la paix sociale.

2. LE CONTEXTE HISTORIQUE ET SOCIO-POLITIQUE DES MIGRATIONS

Lorsque l'on parcourt l'histoire du Cameroun, trois grandes périodes (précoloniale, coloniale, indépendance) se dessinent et permettent de comprendre les événements dans la conjoncture actuelle.

2.1 LA PERIODE PRECOLONIALE

La période précoloniale est celle au cours de laquelle les différentes formes de peuplement se mettent en place. Période de conquêtes, de guerres inter-tribales et de grands bouleversements sur le plan démographique, elle a vu naître et se constituer à travers les savanes et les plateaux des chefferies et royaumes souvent rivaux dont les antagonismes furent à l'origine de nombreux transferts de populations dans l'espace et dans le temps. Sur ce plan, le 19^e siècle fut une période particulièrement mouvementée. Des communautés entières du Nord au Sud furent repoussées sur de longues distances par des adversaires plus puissants et se réfugièrent dans les forêts ou dans les montagnes. Ainsi s'expliquent sans doute ces poches de surpeuplement excessif que l'on retrouve dans les hauts plateaux de l'Ouest et de l'Extrême Nord. A l'Ouest, les Bamiléké, partis de la plaine Tikar par vagues successives depuis le 17^e siècle furent contraints par les Bamoun, organisés en puissance guerrière,

à escalader les montagnes, occupant toute la région située entre le Noun et le Nkam.

Au Nord un grand nombre de communautés païennes se réfugièrent dans les massifs des Mandara au 19^e siècle pour mieux résister aux invasions des peuls islamisés, lancés à la conquête de nouveaux territoires par l'émir de Sokoto. Des motifs analogues furent à l'origine des migrations de beaucoup d'autres groupuscules humains plus ou moins organisés en zone forestière et jusqu'à la bordure côtière. L'arrivée des européens à la fin du 19^e siècle mit fin aux conflits, stoppa les mouvements d'exode ou en changea la nature, et stabilisa les populations à l'intérieur des zones dont les limites marquent la configuration actuelle du peuplement.

2.2 LA PERIODE COLONIALE

La période coloniale changera les données du problème. De 1884 à 1916, c'est la colonisation allemande qui se caractérise par la définition des limites d'un Etat au sens moderne du terme - et des premières circonscriptions administratives, l'introduction des cultures nouvelles et de la monnaie dans le système des échanges, la création des premières compagnies commerciales, le lancement des grands chantiers de construction de chemin de fer avec réquisition forcée de main-d'oeuvre, et la construction des premiers noyaux urbains en région forestière et près de la côte. Toutes ces innovations entraînent des déplacements de populations sur de longues distances.

De 1916 à 1958, le Cameroun subit la double colonisation française et britannique et, avec elle, l'introduction d'autres innovations. Parallèlement à la restructuration de l'espace administratif et politique (nouvelle délimitation du pays et des circonscriptions administratives), il y a à partir de 1925 l'introduction et la caféiculture dans les grassfields, l'Ouest et le Littoral, de la coton-culture dans le Nord et de la cacao-culture dans tout le Sud forestier. Il y a également à la même époque la création de premières plantations industrielles (hévéa, palmier à huile, banane) dans le Mungo et le Sud-Ouest, et le lancement de plusieurs projets de colonisation agricole à l'Ouest et au Nord, lesquels auront un effet mobilisateur énorme sur les populations rurales.

Entre 1925 et 1950, beaucoup de centres urbains sont créés tant dans la partie francophone que dans la partie anglophone du pays. La mise en place des écoles, des centres de santé et d'un réseau appréciable de voies de communication entraîne la redistribution des établissements humains sur tout le territoire. Si tout au long de la période coloniale l'habitat reste groupé très souvent au Nord et dispersé en général à l'Ouest, dans toute la zone forestière les villages sortent de la brousse pour s'aligner le long des routes et pistes créées pour desservir les agglomérations ou faciliter l'évacuation des produits vers la mer.

2.3 L'INDEPENDANCE

En accédant à l'indépendance en 1960, le Cameroun sera tributaire de toutes ces influences du passé. Les systèmes administratifs, éducatifs et sociaux ainsi que les modes d'exploitation ou de production mis en place par les puissances métropolitaines sont maintenus voire consolidés dans l'ensemble. Les plantations industrielles continuent à attirer de la main d'oeuvre. Des projets de développement rural intégré, conçus et mis en oeuvre dans un cadre de partenariat technique et financier avec les étrangers et institutions internationales se mettent à foisonner partout. Un salariat agricole voit le jour dans toutes les zones où se pratiquent des cultures de rente, devenant une motivation supplémentaire d'exode des populations. Cependant, on ne peut pas passer sous silence les troubles politiques violents (guerre civile) qui précédèrent et suivirent de quelques années l'indépendance après avoir bouleversé complètement les pays Bamiléké et Bassa. En effet, de 1958 à 1962, cet événement catalysa dans l'Ouest des courants migratoires intenses en direction du Mungo, du Département du Mbam (Makénéné et Ndikinimeki) et des principales villes du pays.

Le contexte naturel, historique et socio-politique des migrations au Cameroun étant ainsi défini, il s'agit à présent d'étudier les formes qu'elles ont revêtues à travers l'espace et le temps, ce qui permettrait d'en dégager des problématiques politiques, économiques et sociales.

II. TYPOLOGIE DES MOUVEMENTS MIGRATOIRES : REVUE DES EXPERIENCES CAMEROUNAISES

Lorsque l'on considère le problème migratoire dans son ensemble à l'échelle du Cameroun, on peut, en se basant sur les causes, les caractéristiques et même les effets, opérer une classification en quatre groupes:

- les migrations permanentes
- les migrations spontanées
- les migrations organisées ou dirigées
- les opérations de recasement

Les migrations permanentes et les migrations spontanées se rapprochent par leur caractère non dirigé, c'est-à-dire par l'absence à la base du processus d'une volonté politique et d'une orientation des courants vers des objectifs définis à l'avance. Cependant, si les migrations permanentes telles que l'exode rural et le nomadisme sont, pour ainsi dire, des mouvements naturels et continus dans le temps, les migrations spontanées ont des origines et des causes ponctuelles qui peuvent disparaître ou changer de nature mettant ainsi fin au processus migratoire. C'est par exemple ce qui se produit dans certaines régions en période de grande sécheresse ou de famine, durant les conflits armés (exode des réfugiés), lors de la découverte de nouvelles terres ou sources de richesse (implantation d'industries agricoles ou minières...). A l'inverse, les migrations organisées et les opérations de recasement sont des mouvements conçus, provoqués et orientés par les pouvoirs publics en fonction d'objectifs économiques, sociaux ou politiques déterminés dès le départ. Pour la commodité de l'analyse, nous traiterons séparément les différents types de migration.

1. LES MIGRATIONS PERMANENTES

Celles-ci concernent en particulier l'exode rural et le nomadisme. Nous avons déjà évoqué en première partie le cas de l'exode rural sur lequel il n'est plus nécessaire d'insister. Mais, défini comme l'ensemble des mouvements des populations des campagnes vers les villes, son origine est aussi ancienne que la constitution des premiers noyaux urbains. Il a débuté en période précoloniale mais a connu avec la colonisation et surtout après elle une ampleur sans précédent dans l'histoire. Au Cameroun - comme ailleurs partout en Afrique - des villes sont nées et se sont développées pendant que les campagnes, vidées de l'essentiel de leur force active, stagnent ou décroissent.

Quand au nomadisme qui est la mobilité naturelle des populations ayant un certain mode de vie et pratiquant certaines activités, il faudrait comprendre dans ce volet la transhumance des

éleveurs (Bororo notamment) qui, dans la savane et le sahel, changent des zones de pâturage suivant les saisons d'une part, et les migrations ou l'errance des communautés pygmées (Baka et Bakola par exemple) en zone forestière, dont les lieux de résidence alternent avec les saisons de chasse.

Ces formes très anciennes de migrations, qui se pratiquent dans des systèmes écologiques différents, sont statistiquement difficiles à maîtriser ; d'autant plus que les communautés concernées n'ont pas développé la notion de propriété pour l'espace, continuent à se soustraire au réseau d'éducation et d'économie formelles, et ne s'intègrent que difficilement aux communautés sédentaires installées dans leur voisinage. L'on pense cependant qu'avec l'accroissement et la pression démographique ainsi que les contraintes modernes qui imposent des limitations aux ressources naturelles, le nomadisme diminuera de plus en plus au profit d'une nouvelle rationalité économique-sociale marquée par l'intensification, la sédentarisation et l'économie de marché.

2. LES MIGRATIONS SPONTANÉES

Au Cameroun, cette réalité est également ancienne et s'applique à des situations diverses:

- la colonisation du Mungo par les Bamiléké
- la descente des montagnards du Nord-Cameroun dans les plaines
- les migrations des populations de la Lékié vers le Mbam
- les migrations transfrontalières ou internationales

2.1 LA COLONISATION DU MUNGO PAR LES BAMILEKE

Il s'agit ici d'un mouvement qui a commencé durant la période coloniale et qui s'est intensifié durant les premières années de l'indépendance. A l'origine, il y a d'abord l'exiguïté et le surpeuplement du plateau Bamiléké où la pénurie des terres cultivables associée au système de l'habitat a très tôt contraint les populations essentiellement agricoles à quitter leurs terrains pour descendre en zone forestière. Renseignés par d'anciens migrants sur les possibilités de ces milieux, les candidats au départ savaient à l'avance qu'ils pourraient accéder aux terres nouvelles, ou à défaut, devenir salariés agricoles dans les plantations européennes installées non loin de la côte. Doré de riches terres volcaniques inexploitées, insuffisamment peuplé et aisément accessible à la faveur des voies de communication

mises en place par les allemands, le Mungo plus proche fut naturellement l'exutoire privilégié au trop-plein démographique des hauts plateaux de l'Ouest.

D'un autre côté, les troubles politiques qui secouèrent les pays Bamiléké et Bassa entre 1958 et 1963 marquèrent un coup d'accélérateur à cet exode. En quelques années, plus de 300 000 personnes fuyant le maquis et la répression se déversèrent par familles entières dans le Mungo et la ville de Douala. D'autres se dirigèrent vers la Mbam, en particulier vers l'arrondissement de Ndikinimeki et le district de Makénéne où, malgré l'état d'urgence qui y fut proclamé, elles trouvèrent à s'installer. Que ce soit dans le "Couloir du Mungo" ou dans le Mbam, l'intégration ou la cohabitation entre les différentes communautés n'a pas toujours été une chose aisée. Devenus minoritaires dans les zones d'accueil, les autochtones eurent souvent à développer des attitudes de rejet vis-à-vis des arrivants, lesquels s'organisèrent en retour pour préserver leurs acquis.

2.2 LA DESCENTE DES MONTAGNARDS DU NORD-CAMEROUN DANS LES PLAINES

La colonisation spontanée des plaines par les montagnards descendus des massifs au Nord et au Sud des Monts Mandara est un événement significatif. Elle s'est étalée sur six ou sept décennies environ. Comme dans le cas des Bamiléké, elle commence au début des années 20, dans un contexte marqué par le surpeuplement local accentué (plus de 250 habitants/km²) et la dégradation générale des conditions de vie dans les massifs. Mais l'incitateur majeur est surtout la famine de 1931 qui déclencha des descentes d'un grand nombre de montagnards vers les plaines périphériques.

Qu'il s'agisse du Nord ou du Sud des mandara, ces déplacements qui se sont poursuivis sans interruption jusqu'à nos jours (avec parfois quelques remontées) furent un mouvement général. Boutrais, sociologue de l'ORSTOM estime en 1973 que sur une population initiale de 170 000 montagnards environ, près de 100 000 sont descendus. Les Fali de Peské-Bori (8 000 environ) ont tous abandonné leurs montagnes.

Les principales zones d'accueil au Nord des Mandara furent les plaines voisines de Koza, Mora, Méri et Mofou et au Sud les contre-bas des massifs de Tinguelin, Kangou ou Peské-Bori. Le fait de s'installer dans un premier temps à proximité des zones de départ permettait à ces migrants de rester dans le même canton - et donc de se sentir en sécurité - et parfois de continuer l'utilisation des parcelles qu'ils exploitaient déjà depuis la montagne. A ce stade, les problèmes d'adaptation ou d'intégration étaient encore inconnus. Mais au fur et à mesure qu'ils devenaient plus nombreux

que les autochtones et contraints d'aller toujours plus loin, des difficultés surgirent avec les peuls musulmans. L'administration fut obligée d'intervenir par le lancement au début des années 50 des opérations de colonisation agricole dirigée. Cela n'arrêta pas pour autant les migrations spontanées.

2.3 LES MIGRATIONS DES POPULATIONS DE LA LÉKIÉ VERS LE MBAM

En zone forestière, c'est le contraste frappant entre la Lékié et les départements voisins, en particulier le Mbam, qui a attiré l'attention sur une problématique de projet Lékié-Mbam. Alors que la Lékié connaît des densités de 73 à 120 habitants/km² (1976), le Mbam, lui, compte entre 0,7 et 6 habitants/km². La Lékié est peuplée à 80 p.100 d'Etons et Ewondo, sous-groupes de l'ethnie Béti-Fang, et de 15 p.100 de Manguissa ou Batchenga, tandis que le Mbam est habité par une mosaïque de 20 ethnies différentes, dominées à 58 p.100 par les Yambassa, Bafia, Banen, le reste étant composé des Batchenga, Sanaga, Babouté, Bamiléké, Tikar etc. La quasi-totalité de bonnes terres de la Lékié ont été occupées depuis l'époque coloniale par les plantations cacaoyères villageoises, créant une pénurie d'espace pour les cultures vivrières, alors que le Mbam dispose encore en grande quantité de terres vierges de bonne qualité, susceptibles d'être désenclavées et mises en exploitation. Le système foncier et l'organisation sociale traditionnels articulés sur le "Nda-Bot", unité de production, unité politique et unité religieuse, sont cependant identiques dans les deux départements. L'effet d'attraction né de ces déséquilibres ne pouvait donc que s'exercer sur la Lékié qui, depuis plus de trente ans, alimente des courants importants d'exode rural vers Yaoundé, Douala, Mbal-Mayo ou des migrations de travail vers les complexes agro-industriels de Mbandjock (SOSUCAM), de Dizangué (HEVECAM) ou encore vers Edéa (ALUCAM).

L'immigration dans le Mbam des originaires de la Lékié commence bien avant l'indépendance de manière spontanée et s'intensifie au cours des années 70 (traversée de la Sanaga et colonisation progressive du Sud de l'arrondissement de Ntui). Devant cette situation, l'administration sent la nécessité de l'organiser. Les premiers projets de villages pionniers sont initiés en 1961 par l'ONPD (Office National de Participation au Développement) à Minkama, dans la Lékié même. Ils étaient destinés à accueillir 36 familles sur 130 hectares aménagés, mais se soldèrent par un échec à cause des problèmes fonciers et de conflits inter-ethnies que le maître d'oeuvre de l'opération, en plus de sa propre mauvaise gestion, n'avait pas prévu. En 1974, un autre village pionnier ayant pour but d'accueillir 300 personnes est créé près de Yoko et échoue pour les mêmes raisons. En 1979-80, le Ministère des Affaires Sociales lance le projet "1.000 familles dans le Mbam" à installer dans la zone Goura-Mont Tama. Faute de bonnes

études préparatoires et surtout de financement, ce projet ne connaîtra pas un début de réalisation. La migration spontanée se poursuit toujours suivant sa propre rationalité et d'après les organismes missionnaires installés dans la région (CRAT) qui interviennent de temps en temps pour l'encadrer, celle-ci connaît plus de succès.

2.4 LES MIGRATIONS TRANSFRONTALIÈRES OU INTERNATIONALES

Elles concernent les échanges humains fréquents à travers les frontières nationales. Difficiles à saisir du point de vue statistique à cause de l'ancienneté du phénomène, de la longueur et du caractère incontrôlable de ces frontières ainsi que l'apparemment poussé des ethnies qui sont à cheval sur ces limites artificielles, ces migrations font partie intégrante des échanges entre le Cameroun et ses voisins. Les cas les plus spectaculaires concernent les déplacements forcés des réfugiés d'un pays à l'autre durant les conflits politiques nationaux. A deux reprises le Cameroun a été le terrain d'accueil de cette forme de migration : d'abord avec la guerre civile de Biafra (Nigéria) qui entre 1967-1971 fit déferler dans la partie occidentale du pays un nombre important d'immigrants d'origine Ibo ; ensuite avec la longue guerre civile du Tchad qui au cours des années 70 et 80 a déversé des centaines de milliers de personnes dans les provinces septentrionales et même dans les grandes villes du Sud. La paix revenue, un grand nombre de ces réfugiés ont regagné leur pays d'origine. Mais beaucoup d'autres ont pu se fixer définitivement avec leurs familles dans les centres urbains où ils exercent des petits métiers du secteur informel pour vivre.

3. LES MIGRATIONS ORGANISÉES OU DIRIGÉES

Contrairement aux migrations spontanées qui viennent d'être décrites, les migrations organisées ont toujours été des opérations volontaristes menées par les pouvoirs publics pour résoudre un problème démographique ou un problème économique. Plusieurs expériences que nous allons passer sommairement en revue ont été tentées depuis le début des années 30 et ont connu des fortunes diverses. Elles sont localisées essentiellement à l'Ouest-Cameroun et dans le Nord, c'est-à-dire à proximité des grands foyers de peuplement :

- Opération Rive Gauche du Noun (1930)
- Opération Yabassi-Bafang (1966)
- Les "Casiers de colonisation" du Nord-Cameroun (1950)
- Le Projet Nord-Est Bénoué (1974)

3.1 OPERATION RIVE GAUCHE DU NOUN

Ce projet de colonisation agricole dirigée a été conçu dès 1925 par les administrateurs de la France d'Outre-Mer (FOM) en poste dans la subdivision de Bafoussam. Elle démarre effectivement sur le terrain en 1930. C'est la plus ancienne opération de ce genre au Cameroun. A l'origine, elle avait pour but de contribuer au décongestionnement des chefferies surpeuplées du plateau Bamiléké. Elle visait partout à mettre un terme aux querelles intertribales nées de la pression foncière qui secouaient les chefferies de la subdivision de Bafoussam, par l'ouverture et la mise à la disposition de leurs ressortissants des riches terres inoccupées situées sur la rive gauche de la rivière Noun.

Des campagnes d'information et de sensibilisation furent menées auprès des chefs traditionnels dont beaucoup refusèrent d'y envoyer des gens, craignant qu'une partie de leurs sujets ne tombât sous l'influence du Sultan Bamoun, leur adversaire de toujours. Les administrateurs coloniaux les rassurèrent en leur promettant que les populations ainsi installées resteraient sous leur juridiction. Quelques chefs acceptèrent, mais au début, seuls les indésirables et les bannis coutumiers y furent envoyés. La réussite des premiers migrants suscita un engouement dans les villages d'origine, amenant beaucoup d'autres personnes, surtout les gens sans terre, à s'y rendre spontanément. On les regroupa suivant leurs origines tribales dans huit sous-chefferies portant le nom des chefferies-mères : Bandjoun II, Bamougoum II, Bafoussam II, Bâmendjou II, Baham II, Bangou II, Bayangam II et Batoufam II.

Chacune était placée sous l'administration d'un sous-chef et dépendait socialement, juridiquement et politiquement de la chefferie-mère. Ces groupements connurent une croissance sensible. En 1933-34, 3 500 personnes y étaient dénombrées. En 1936-37, la population avait presque doublé. Les administrateurs de la FOM envisagèrent la création d'une "deuxième Rive Gauche du Noun" dans la région de Nkogam située plus au Nord. La deuxième guerre mondiale stoppa le processus. A partir de 1939, la population des villages pionniers cessa d'augmenter.

Après l'indépendance, le Sultan Bamoun se mit à réclamer de plus en plus le droit d'exercer sa tutelle directe sur les Bamiléké installés sur son territoire qui lui échappaient. L'administration donna son aval à cette requête et le 19 octobre 1967, un arrêté préfectoral (le n° 268/AP/DEM) fut signé portant "bamounnisation" des villages pionniers de la Rive Gauche du Noun. Les noms Bamiléké furent remplacés par les noms Bamoun. Ainsi, Bandjoun II devient Tenjouonoun ; Bamougoum II, Kuetsu ; Bafoussam II, Momo ;

Bamendjou II, Mfeloung; Bangou II, Nkoupka ; Baham II, Rap-Noun ; Bayangam II, Njimbouot II et Batoufam II, Njimbouot I. Mais ce fut aussi la fin de cette opération de colonat puisque la population se mit à désertir la zone au profit du salariat agricole dans les plantations européennes de Foubot, ou d'emplois plus rémunérateurs dans les villes.

3.2 OPERATION YABASSI-BAFANG

Identifiée depuis 1964 par la SCET-Coopération, un organisme français de droit public sur financement du FAC, l'opération Yabassi-Bafang est à l'origine "une expérience de développement intégré destinée à tester à une échelle relativement importante une méthode de mise en valeur à faible coût généralisable". La phase expérimentale démarre effectivement en 1966-67 après la construction de la route Yabassi-Bafang par le Génie militaire.

Les objectifs de ce projet étaient identiques à ceux de la Rive Gauche du Noun : décongestionner les départements du haut plateau Bamiléké à très forte pression démographique, désenclaver une base zone sous-peuplée et non cultivée par la mise en valeur des terres agricoles disponibles. Mais il y avait aussi en-dessous de ces buts contenus dans l'avant-projet des objectifs politico-stratégiques : couper et isoler les maquisards qui animaient encore les troubles politiques en pays Bamiléké de leur zone de retraite dans la forêt dense du Nkam.

Le périmètre identifié était de 120 000 hectares dont 55 000 hectares entre la rivière Nkam et la Makombé. Sur cet espace, 30 "terroirs" furent délimités comprenant d'une part les terres occupées par les autochtones ou nécessaires à leur extension, et d'autre part tout le reste englobé dans le "patrimoine collectif national" aux fins d'une rétrocession aux pionniers qui les auront défrichées et mises en valeur. Ainsi, l'accession à la propriété foncière devait constituer la motivation essentielle des futurs pionniers. Il était prévu en deux tranches l'installation de 2 230 pionniers jusqu'en 1971, 4 500 en 1976 et 9 000 en 1981 pour une population totale de 35 à 45 000 habitants. Les recrutements eurent lieu dans les cinq départements Bamiléké et au-delà, mais après cinq ans, seuls 1 180 pionniers avaient pu être installés. En 1972, un taux d'abandon de 25 p.100 avait déjà été enregistré.

En 1970, la SODENKAM (Société de Développement du Nkam) fut créée pour prendre la relève de la SCET-Coopération. Parmi les buts qui lui furent assignés figuraient entre autres la poursuite du recrutement, de l'installation et de l'encadrement des pionniers, la mise en place des infrastructures et la création d'organismes coopératifs pour assurer la commercialisation des produits. Il était aussi prévu que "les pionniers seraient amenés progressivement à s'intéresser à

la gestion de l'opération et ultérieurement même à l'assurer complètement".

Les expérimentations portaient sur le café, le cacao et les cultures vivrières. Chaque pionnier recevait un lot de 3 000 m² proche du village pour pratiquer les cultures vivrières et un autre de 4 hectares plus éloigné pour les cultures industrielles, en plus de l'aide que la SODENKAM lui apportait pour la construction de sa case et l'achat du matériel agricole.

Au moment où en 1987-88, le Gouvernement camerounais, confronté à des difficultés financières énormes, décide de la dissolution de la SODENKAM, les résultats de l'opération après 20 années d'évolution sont les suivants :

- 18 villages ont été créés sur 64 prévus soit un taux de réalisation de 26 p.100 ;
- 7 000 pionniers environ ont été recrutés et 1 800 fixés sur 9 000 prévus ; la population des villages n'était que de 6 800 habitants sur une prévision de 35-45 000, soit un taux de déperdition très élevé et un taux de réalisation extrêmement faible ;
- Cependant, des infrastructures considérables ont été mises en place (97 km de piste ouvertes, 19 points d'eau, 13 écoles primaires ou maternelles, 8 dispensaires créés, des bureaux et des magasins construits etc.) ;
- la production caféière était passée de zéro à plus de 4 000 tonnes et la production cacaoyère de zéro à 236 tonnes entre 1970-1987 ;
- 7 000 hectares de caféiers, 4 500 hectares de cacaoyers et 4 000 hectares de cultures vivrières ont été réalisés ;
- Mais la SODENKAM aura dépensé au cours de cette période près de 9,5 milliards de F CFA constitués à 70 p.100 des subventions de l'Etat et à 30 p.100 du produit de ses prestations.

Globalement, si les résultats en terme d'infrastructure et de production agricole ont été positifs, les résultats économiques et sociaux de l'Opération Yabassi-Bafang ont été un échec. L'effet d'allègement démographique recherché sur les plateaux est resté insensible, tout comme l'effet d'entraînement économique des périmètres d'accueil, bien que les pionniers soient unanimement reconnus comme une population extrêmement dynamique.

A l'origine de cet échec il y a d'abord les problèmes fonciers et les contradictions fondamentales inhérentes à la gestion des sociétés

d'Etat. La motivation première du pionnier était de devenir planteur-propriétaire avec un titre foncier en bonne et due forme sur la parcelle qu'il exploitait. A cause des pressions psychologiques diverses et des influences socio-politiques extérieures, cette promesse du cahier des charges qui garantissait à l'exploitant l'accès à la propriété définitive après constat de mise en valeur ne fut jamais satisfaite. D'où la désaffection d'un grand nombre de migrants qui ne tardèrent pas à regagner leurs anciens villages ou les grandes villes. D'autre part, la SODENKAM, organisme para-public, était devenue avec le temps une machine lourde et bureaucratique (plus de 20 cadres et 380 agents pour une masse salariale de 420 millions de F CFA en 1987). Ses dispositions statutaires ne lui donnaient en outre compétence que pour l'encadrement des villages pionniers et non des villages autochtones, ce qui suscita de la part des chefs et notables locaux une réaction de défense vis-à-vis du projet et perturba dangereusement le climat social favorable à l'intégration entre les nouveaux colons et ces derniers. Enfin, non seulement la SODENKAM a failli à l'une de ses missions fondamentales qui était d'aménager le cadre nécessaire à l'émergence d'unités coopératives pour promouvoir l'auto-gestion des paysans, mais aussi elle est restée cloisonnée dans l'arrondissement de Nkondjock, entraînant de la part de l'élite régionale non originaire de cet arrondissement une attitude d'indifférence souvent préjudiciable à l'accomplissement de ses programmes d'action.

3.3 LES "CASIERS DE COLONISATION" DU NORD-CAMEROUN

Ces expériences qui se sont déroulées avant l'indépendance entre les vallées du Logone, du Diamaré et du Mayo Kébi sont intéressantes à relever parce qu'elles ont servi d'une certaine manière d'étapes préparatoires à des opérations migratoires plus systématiques. Nous avons déjà relevé le contexte physique et naturel de l'Extrême-Nord-Cameroun, fait de fortes densités démographiques dans les massifs des Monts Mandara, les plaines du Logone et du Diamaré, de la pénurie de bonnes terres, des aléas climatiques et de la baisse de la productivité. Depuis le début des années trente, ces circonstances défavorables contraignent les populations surtout d'origine montagnarde à émigrer spontanément vers les basses terres périphériques.

En 1950, l'Administration entreprend d'organiser cette descente généralisée en lançant, par des mesures autoritaires, les premières opérations migratoires vers les plaines à partir des massifs au nord des Mandara. Celles-ci sont un échec, car parmi ceux qui étaient descendus, un grand nombre regagnent les montagnes. En 1954, le secteur expérimental de modernisation du Nord (SEMORD) entame des essais de "casiers de colonisation" dans la plaine de Koza, à l'ouest de Mora.

En 1956, d'autres périmètres sont ouverts à Sanguéré près de Garoua, à Larback et Winde Yola (encore appelé colonat de Guider), à Zouvoul près de Mokolo, enfin à Mokyo et Aïssahardé non loin de Mora.

Le principe d'installation des migrants dans ces "casiers de colonisation" consistait en l'attribution de lots d'exploitation parfaitement identiques, la dispersion obligatoire de l'habitat, des rotations de cultures uniformes et le respect d'une jachère fixée par l'autorité. Les superficies de formes géométriques "casiers" à l'intérieur desquelles les exploitants étaient astreints à des disciplines culturelles strictes variaient de quelques centaines à quelques milliers d'hectares. Les blocs, eux-mêmes divisés en carrés, unités d'exploitation, ainsi que les pistes de délimitation étaient matérialisés par des bornes en ciment. Aux yeux des promoteurs, ce système présentait "l'avantage de supprimer toutes les contestations foncières qui pourraient surgir avec les populations en place". Zouvoul et Mokyo, périmètres installés en 1958-62, en étaient les exemples les plus frappants. Inspiré par ces expériences, le Fonds européen de développement (FED) avait aussi ouvert le périmètre de Doulo-Ganey (par Mora) en 1956 destiné à accueillir 1 000 familles.

Mais ces modèles rigides de colonats enfermés dans des canevas apparemment rationnels ne purent résister à l'épreuve du temps ; car ils ne correspondaient pas à la diversité des conditions locales et aux habitudes agricoles des paysans. Toutes les expériences furent abandonnées entre 1963-1967. De 1970 à 1973, les nouveaux projets de colonisation agricole initiés dans la Haute Bénoué, à l'instar du projet Guider-Bé dans les zones de Soukoundou - Babouri, Mayo-Oulo et Guirvizi-Daval, étaient plus fondés sur une canalisation des mouvements migratoires spontanés - restés importants - que sur un lotissement autoritaire et géométrique.

3.4 LE PROJET NORD-EST BENOUE

A cause de son sous-peuplement, de la disponibilité de bonnes terres et surtout de la bonne pluviométrie régionale, le bassin de la Bénoué a toujours exercé un effet d'attraction sur les populations des zones surpeuplées de l'Extrême-Nord, et en particulier en période de sécheresse. C'est dans ce contexte que le Projet Nord-Est Bénoué est lancé en 1974 avec pour maître d'oeuvre la Mission d'études et d'aménagement de la vallée supérieure de la Bénoué (MEAVSB), un organisme d'Etat créé en 1973 pour assurer l'encadrement de la colonisation agricole amorcée avant l'indépendance. Il était financé par le FED dans le cadre des conventions successives signées avec la République du Cameroun. Son objectif initial était "l'ouverture, l'aménagement et la mise à la disposition des familles paysannes originaires de l'Extrême-Nord des terres non occupées du bassin de la Bénoué".

A cet objectif sont venues se greffer d'autres actions : amélioration et extension des infrastructures socio-économiques de base (routes, points d'eau, écoles, centres de santé...), aménagement des terroirs à vocation agricole, animation rurale, appui à la production, défense de l'environnement et protection de l'équilibre écologique etc. La construction du barrage de Lagdo en 1979 a créé des opportunités supplémentaires (pêche, agriculture irriguée, échanges) en stimulant une immigration lointaine de pêcheurs nigériens, tchadiens, maliens, nigériens...

Le projet NEB est ici une opération migratoire d'une ampleur sans précédent dans l'histoire de la sous-région d'Afrique Centrale. Durant les dix premières années de son lancement, des campagnes de sensibilisation sont menées dans les régions de départ par les responsables du projet, les autorités administratives et même les anciens migrants. Les migrants partant par familles entières (hommes, femmes, enfants, biens), sont transportés par les véhicules du projet, sont installés dans les zones d'accueil suivant leur appartenance ethnique. Parallèlement à cette migration organisée, la migration spontanée s'est poursuivie et intensifiée. Aussi, quand en 1986, les responsables du projet, dépassés par les événements, décident de suspendre la migration organisée pour évaluer les précédentes phases, toutes les prévisions sont dépassées.

Ainsi, entre 1975 et 1989, la superficie du périmètre est passée de 7 282 km² à 11 480 km² ; la densité démographique est passée de 3,2 habitants au km² à 15,3 hab/km². La population qui était de 23 000 habitants en 1973 est passée à 26 000 habitants en 1975, 112 000 habitants en 1982 et 175 000 habitants en 1989. Parmi ces derniers, 80 000 migrants étaient recensés dont 43 000 organisés et 37 000 spontanés. Étaient recensées également 23 ethnies ou clans montagnards impliqués dans le processus (Mada, Kapsiki, Mafa, Mofou, Matakam...) et 19 ethnies ou clans originaires des plaines (Guiziga, Moudang, Toupouri, Guidar, Mousgoum...). Au total les montagnards représentaient 25 p.100 de migrants organisés et les originaires des plaines 75 p.100. Rapidement, les autochtones d'origine Foulbé musulmans sont devenus minoritaires dans la plaine, représentant 46,3 p.100 de la population contre 53,7 p.100 de migrants. En 1986, ils n'étaient majoritaires que dans 160 villages (34 p.100) sur 475. Si officiellement la migration organisée a été arrêtée, la migration spontanée elle s'est poursuivie. Au début de l'année 1990, 12 000 nouveaux migrants étaient recensés dans le périmètre ! Devant un tel engouement, on envisage aujourd'hui sérieusement d'ouvrir d'autres fronts de colonisation en direction de l'Ouest-Bénoué, et de rendre plus systématique l'encadrement de la migration vers le Sud-Est Bénoué.

Parmi les problèmes confrontés depuis 16 ans dans le cadre de cette opération figure tout naturellement la question d'harmonie et d'intégration entre les communautés ethniques qui se superposent dans la région. Si au départ l'immigration était une chose presque souhaitée par les chefs autochtones (lamibé) qui y voyaient une source supplémentaire de revenus à travers la "Zakkat" et l'impôt forfaitaire, avec le temps elle est devenue pour eux un sujet de préoccupation majeure au fur et à mesure que les effectifs augmentaient et que la compétition pour les bonnes terres devenait plus âpre. Les migrants étant essentiellement agriculteurs, ce sont les zones d'élevage, activité principale des autochtones, qui se sont trouvées rétrécies. De même, les migrants issus de systèmes sociaux différents étaient animistes ou chrétiens et n'arrivaient pas à s'adapter aux coutumes locales. Ils ont toujours cherché à conserver et à affirmer leur identité. Il en a résulté inévitablement des conflits autochtones/migrants, certes sans expressions violentes sensibles, mais prenant parfois la forme de tensions éleveurs/agriculteurs ou musulmans/animistes.

4. LES OPERATIONS DE RECASEMENT

Elles diffèrent des autres projets ou mouvements migratoires déjà décrits par leur caractère spontané, ponctuel, parfois massif et orienté sous l'influence d'une contrainte extérieure. Les populations déguerpies et recasées dans un espace différent participent toutes d'une logique globale de développement ou de sauvegarde au bénéfice d'un agent catalyseur qui en définit les principes, les modalités et les contours. La revue des cas au Cameroun laisse apparaître des opérations de déguerpissement-recasement liées à la construction des barrages artificiels, aux catastrophes naturelles et aux petits colonats ou lotissements ruraux.

4.1 LA CONSTRUCTION ET LA MISE EN EAU DE BARRAGES ARTIFICIELS

Dans ce cadre, le Cameroun a déjà réalisé un certain nombre d'ouvrages permettant la création de lacs artificiels qui ont modifié les données de l'environnement:

- la digue de Maga pour la riziculture dans les périmètres SEMRY au Nord (1954-1971)
- la retenue de Mbakaou dans l'Adamaoua (1970-72)
- la retenue de Bamendjin dans l'Ouest (1974-75)
- la retenue de la Mape entre l'Ouest et l'Adamaoua (1985-86)

- le barrage hydro-électrique de Lagdo (1978-79).

En l'absence de données suffisantes, seuls les deux derniers cas seront analysés, lesquels montrent d'ailleurs que la problématique de recasement est presque la même partout.

4.1.1 LE DEGUERPISSEMENT-RECASEMENT DU BARRAGE DE LA MAPE (OUEST-CAMEROUN)

Situé dans la plaine Tikar, à cheval entre les provinces de l'Ouest, du Nord-Ouest et de l'Adamaoua, le barrage-réservoir de la Mapé a été construit en 1985-1986 sur la rivière du même nom afin de contribuer, comme les barrages de Bamendjin sur le Noun et celui de Mbakaou sur le Djérem, à la régulation du cours de la Sanaga pour accroître la capacité de production des centrales hydro-électriques de Song-Loulou et d'Edéa. La retenue devait s'étendre sur une superficie de 520 km², contenir 3,3 millions de m³ d'eau et toucher à des degrés divers 14 villages dans deux des trois principales unités administratives de la zone (Magba et Bankim), 636 familles pour une population totale de 8 500 personnes devaient être sinistrées, c'est-à-dire être transférées sur d'autres sites en perdant leurs cases et leurs cultures.

Des inventaires de déguerpissement permirent d'établir quantitativement l'ensemble des biens indemnifiables et la valeur de ces biens. La contre-partie fut versée en argent liquide aux familles touchées et des plates-formes furent aménagées sur les nouveaux sites d'accueil pour leur installation. Mais au moment de partir en 1988 certains villages refusèrent de regagner les sites qui leur avaient été assignés au départ "pour des raisons d'incompatibilité historique avec les villages voisins". Ainsi, Boitikong, Golori et Kongui dans l'arrondissement de Bankim refusèrent d'être installés dans la zone de Sonkolong. De même, Makoupa-le-Grand et Mabonko dans l'arrondissement de Magba refusèrent la zone de Mbankop et s'installèrent non loin du lac et de leurs anciens sites en dépit des nuisances liées à cette proximité (maladies hydriques).

Pour comprendre ce problème, il faut se situer dans le contexte général de la complexité de la Plaine Tikar. La construction du barrage de la Mapé a été un facteur supplémentaire de perturbation dans cette région.

En effet, en plus d'être à cheval sur trois provinces et d'être frontalière du Nigéria, la Plaine Tikar appartient à deux zones linguistiques différentes (anglophone et francophone). Elle compte en 1988, 54 000 habitants répartis dans onze chefferies traditionnelles pour une densité de 9 à 13 habitants/km² - un grand contraste par rapport aux fortes densités démographiques des plateaux voisins du Nord-Ouest et de l'Ouest. Elle est pourtant d'occupation très ancienne: les

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Cependant, nonobstant ces sensibilités dont certaines causes sont d'ordre foncier, l'intégration entre les communautés en présence reste encore globalement sans problème majeur. Les principales ethnies ont un fond culturel commun avec les Tikar. Les terres de bonne qualité ne manquent pas pour les cultures industrielles et vivrières. Une bonne délimitation des espaces et des activités (zonage) aplanirait les difficultés de cohabitation entre agriculteurs et éleveurs. Les autochtones reconnaissent et apprécient le dynamisme laborieux des migrants qui leur sert en retour de stimulant.

4.1.2 LE DEGUERPISSEMENT - RECASEMENT DU BARRAGE DE LAGDO (NORD-CAMEROUN)

Le barrage de Lagdo a été construit en 1978-79 dans la vallée supérieure de la Bénoué dans le but de créer une retenue d'eau de 900 km² environ pour la production de l'énergie

A cet objectif sont venues se greffer d'autres actions : amélioration et extension des infrastructures socio-économiques de base (routes, points d'eau, écoles, centres de santé...), aménagement des terroirs à vocation agricole, animation rurale, appui à la production, défense de l'environnement et protection de l'équilibre écologique etc. La construction du barrage de Lagdo en 1979 a créé des opportunités supplémentaires (pêche, agriculture irriguée, échanges) en stimulant une immigration lointaine de pêcheurs nigériens, tchadiens, maliens, nigériens...

Le projet NEB est ici une opération migratoire d'une ampleur sans précédent dans l'histoire de la sous-région d'Afrique Centrale. Durant les dix premières années de son lancement, des campagnes de sensibilisation sont menées dans les régions de départ par les responsables du projet, les autorités administratives et même les anciens migrants. Les migrants partant par familles entières (hommes, femmes, enfants, biens), sont transportés par les véhicules du projet, sont installés dans les zones d'accueil suivant leur appartenance ethnique. Parallèlement à cette migration organisée, la migration spontanée s'est poursuivie et intensifiée. Aussi, quand en 1986, les responsables du projet, dépassés par les événements, décident de suspendre la migration organisée pour évaluer les précédentes phases, toutes les prévisions sont dépassées.

Ainsi, entre 1975 et 1989, la superficie du périmètre est passée de 7 282 km² à 11 480 km² : la densité démographique est passée de 3,2 habitants au km² à 15,3 hab/km². La population qui était de 23 000 habitants en 1973 est passée à 26 000 habitants en 1975, 112 000 habitants en 1982 et 175 000 habitants en 1989. Parmi ces derniers, 80 000 migrants étaient recensés dont 43 000 organisés et 37 000 spontanés. Etaient recensées également 23 ethnies ou clans montagnards impliqués dans le processus (Mada, Kapsiki, Mafa, Mofou, Matakam...) et 19 ethnies ou clans originaires des plaines (Guiziga, Moudang, Toupouri, Guidar, Mousgoum...). Au total les montagnards représentaient 25 p.100 de migrants organisés et les originaires des plaines 75 p.100. Rapidement, les autochtones d'origine Foulbé musulmans sont devenus minoritaires dans la plaine, représentant 46,3 p.100 de la population contre 53,7 p.100 de migrants. En 1986, ils n'étaient majoritaires que dans 160 villages (34 p.100) sur 475. Si officiellement la migration organisée a été arrêtée, la migration spontanée elle s'est poursuivie. Au début de l'année 1990, 12 000 nouveaux migrants étaient recensés dans le périmètre ! Devant un tel engouement, on envisage aujourd'hui sérieusement d'ouvrir d'autres fronts de colonisation en direction de l'Ouest-Bénoué, et de rendre plus systématique l'encadrement de la migration vers le Sud-Est Bénoué.

Parmi les problèmes confrontés depuis 16 ans dans le cadre de cette opération figure tout naturellement la question d'harmonie et d'intégration entre les communautés ethniques qui se superposent dans la région. Si au départ l'immigration était une chose presque souhaitée par les chefs autochtones (lamibé) qui y voyaient une source supplémentaire de revenus à travers la "Zakkat" et l'impôt forfaitaire, avec le temps elle est devenue pour eux un sujet de préoccupation majeure au fur et à mesure que les effectifs augmentaient et que la compétition pour les bonnes terres devenait plus âpre. Les migrants étant essentiellement agriculteurs, ce sont les zones d'élevage, activité principale des autochtones, qui se sont trouvées rétrécies. De même, les migrants issus de systèmes sociaux différents étaient animistes ou chrétiens et n'arrivaient pas à s'adapter aux coutumes locales. Ils ont toujours cherché à conserver et à affirmer leur identité. Il en a résulté inévitablement des conflits autochtones/migrants, certes sans expressions violentes sensibles, mais prenant parfois la forme de tensions éleveurs/agriculteurs ou musulmans/animistes.

4. LES OPERATIONS DE RECASEMENT

Elles diffèrent des autres projets ou mouvements migratoires déjà décrits par leur caractère spontané, ponctuel, parfois massif et orienté sous l'influence d'une contrainte extérieure. Les populations déguerpies et recasées dans un espace différent participent toutes d'une logique globale de développement ou de sauvegarde au bénéfice d'un agent catalyseur qui en définit les principes, les modalités et les contours. La revue des cas au Cameroun laisse apparaître des opérations de déguerpissement-recasement liées à la construction des barrages artificiels, aux catastrophes naturelles et aux petits colonats ou lotissements ruraux.

4.1 LA CONSTRUCTION ET LA MISE EN EAU DE BARRAGES ARTIFICIELS

Dans ce cadre, le Cameroun a déjà réalisé un certain nombre d'ouvrages permettant la création de lacs artificiels qui ont modifié les données de l'environnement:

- la digue de Maga pour la riziculture dans les périmètres SEMRY au Nord (1954-1971)
- la retenue de Mbakaou dans l'Adamaoua (1970-72)
- la retenue de Bamendjin dans l'Ouest (1974-75)
- la retenue de la Mape entre l'Ouest et l'Adamaoua (1985-86)

- le barrage hydro-électrique de Lagdo (1978-79).

En l'absence de données suffisantes, seuls les deux derniers cas seront analysés, lesquels montrent d'ailleurs que la problématique de recasement est presque la même partout.

4.1.1 LE DEGUERPISSEMENT-RECASEMENT DU BARRAGE DE LA MAPE (OUEST-CAMEROUN)

Situé dans la plaine Tikar, à cheval entre les provinces de l'Ouest, du Nord-Ouest et de l'Adamaoua, le barrage-réservoir de la Mapé a été construit en 1985-1986 sur la rivière du même nom afin de contribuer, comme les barrages de Bamendjin sur le Noun et celui de Mbakaou sur le Djérem, à la régulation du cours de la Sanaga pour accroître la capacité de production des centrales hydro-électriques de Song-Loulou et d'Edéa. La retenue devait s'étendre sur une superficie de 520 km², contenir 3,3 millions de m³ d'eau et toucher à des degrés divers 14 villages dans deux des trois principales unités administratives de la zone (Magba et Bankim), 636 familles pour une population totale de 8 500 personnes devaient être sinistrées, c'est-à-dire être transférées sur d'autres sites en perdant leurs cases et leurs cultures.

Des inventaires de déguerpissement permirent d'établir quantitativement l'ensemble des biens indémniables et la valeur de ces biens. La contre-partie fut versée en argent liquide aux familles touchées et des plates-formes furent aménagées sur les nouveaux sites d'accueil pour leur installation. Mais au moment de partir en 1988 certains villages refusèrent de regagner les sites qui leur avaient été assignés au départ "pour des raisons d'incompatibilité historique avec les villages voisins". Ainsi, Boitikong, Golori et Kongui dans l'arrondissement de Bankim refusèrent d'être installés dans la zone de Sonkolong. De même, Makoupa-le-Grand et Mabonko dans l'arrondissement de Magba refusèrent la zone de Mbankop et s'installèrent non loin du lac et de leurs anciens sites en dépit des nuisances liées à cette proximité (maladies hydriques).

Pour comprendre ce problème, il faut se situer dans le contexte général de la complexité de la Plaine Tikar. La construction du barrage de la Mapé a été un facteur supplémentaire de perturbation dans cette région.

En effet, en plus d'être à cheval sur trois provinces et d'être frontalière du Nigéria, la Plaine Tikar appartient à deux zones linguistiques différentes (anglophone et francophone). Elle compte en 1988, 54 000 habitants répartis dans onze chefferies traditionnelles pour une densité de 9 à 13 habitants/km² - un grand contraste par rapport aux fortes densités démographiques des plateaux voisins du Nord-Ouest et de l'Ouest. Elle est pourtant d'occupation très ancienne: les

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hydro-électrique, l'agriculture irriguée, la pêche et, éventuellement, la régulation du cours de la Bénoué en vue de prolonger sa navigabilité saisonnière. Dans la zone submersible, 4 700 personnes réparties dans 47 villages et 843 furent recensées. Ces personnes appartenaient à 38 groupes ethniques différents dominés à 70 p.100 par la communauté peule et cohabitaient sans problème apparent sur les territoires appartenant à deux des plus importants lamidats de la région: Garoua et Rey-Bouba. 96 p.100 d'entre elles avaient l'agriculture pour activité principale et 4 p.100 s'occupaient essentiellement de l'élevage, de la pêche ou des échanges.

Après les inventaires de déguerpissement, sept zones de réinstallation furent identifiées sur la base des critères apparemment bien choisis:

- liens existants ou affinités traditionnelles entre les villageois;
- présence des terres cultivables en quantité et en qualité suffisante;
- accessibilité des sites choisis (le long des voies de communication);
- maintien des villages dans le lamidat d'origine;
- éloignement raisonnable du lac pour éviter les maladies hydriques et maintenir l'activité pêche;
- regroupement de certains villages à faible population pour maximiser l'usage des équipements;
- possibilité d'installation des équipements de base (points d'eau, écoles, centre de santé ...).

Les nouveaux villages créés devaient abriter chacun une population de 100 à 150 habitants et conserver autant que possible les règles d'alliances établies avant le transfert. Compte tenu de tous ces éléments reconnus dès le départ sur la base d'études socio-économiques bien menées, les opérations de déguerpissement-recasement à Lagdo furent globalement une épreuve réussie. Mais il faut comprendre que d'autres éléments du contexte avaient déjà préparé le terrain de ce succès.

Il y a d'abord le fait que la zone était habitée par une population habituée aux mouvements migratoires depuis des décennies. Que ce soit les éleveurs nomades, les peuls sédentaires et islamisés qui investirent la région au 19ème siècle, ou encore les ethnies païennes originaires des montagnes comme les Fali, les Papé, les Dourou et autres, le transfert d'un site à un autre ne semblait être pour aucun de ces groupes une catastrophe psychologique, puisque la nature les y a longtemps préparés (cycles de sécheresse et de famine).

Il y a ensuite la faible densité démographique de la zone au moment de la mise en eau du barrage (moins de 10 hab/km²) et la présence de bonnes terres et des conditions pluviométriques favorables dans toute la plaine. Le recasement ne pouvait donc représenter pour les groupes concernés ni une perte ni un gain appréciable de terroirs.

Malgré le nombre d'ethnies en présence, il y a également leur allégeance reconnue vis-à-vis des Lamibé de Garoua et de Rey-Bouba dont l'adhésion à un projet de ce genre est presque une garantie de réussite. En effet, le caractère fortement centralisé de l'organisation socio-politique traditionnelle autour du lamido en fait une structure énorme de pression. Le pouvoir s'égrène depuis le lamido au sommet jusqu'aux "jauros" ou chefs de village à la base, en passant par les grands serviteurs royaux (Faada) et les chefs de provinces (Lawan). Fort de cette structure hiérarchisée, le puissant monarque administre de vastes territoires conquis au siècle dernier et issus du morcellement de l'ancienne principauté de l'Adamaoua, dans l'émirat peul de Sokoto. Par exemple, le Lamidat de Garoua couvre 2 720 km² divisés en trois secteurs: Garoua-Centre (375 km²), Garoua-Ouest (600 km²) et Garoua-Sud (1745 km²). Celui du Rey-Bouba, le plus influent couvre une superficie de 36 000 km² subdivisée en 32 secteurs ou Lawamats dont Kongrong, Djouroum, Dobia, Rey, Rive-Droite-Benoué et Rive-Gauche-Benoué sont les plus importants. Il s'étend aussi sur deux arrondissements (Rey-Bouba et Tcholliré) et un district (Touboro).

Un autre facteur à souligner est le régime foncier traditionnel qui fait du lamido le propriétaire coutumier de la terre dont il peut concéder le droit d'usage à ses sujets ou à tout autre exploitant. Ceux-ci doivent en retour, après chaque saison, payer au souverain une dîme "zakkat" équivalente au dixième de la récolte. Tant qu'un chef de famille, autochtone ou immigré, travaille une terre et respecte ces obligations, elle lui revient tout comme à ses successeurs s'ils continuent sa mise en valeur. Ce système, fondé sur un régime d'usufruit dans un contexte spatial dégagé, prive la compétition foncière de son objet et, partant, réduit les tensions sociales qui ailleurs la sous-tendent.

Il y a enfin l'action de la MEAVSB, société d'Etat installée dans la région en 1973 pour organiser les migrations. Dotée de puissants moyens, elle avait aménagé le cadre d'intervention et de concertation nécessaire aux opérations et pouvait, en temps opportun, rétablir sur les nouveaux sites les équipements perdus sur les anciens sans rompre la cohérence globale du développement.

4.2 LES CATASTROPHES NATURELLES (NYOS ET NJIDOU)

Le monde entier a été en émoi lorsque le 21 août 1986, le Cameroun fut frappé d'une catastrophe de grande ampleur et tout à fait inhabituelle: l'explosion de gaz mortel à partir d'un lac de cratère (Nyos), situé dans la province du Nord-Ouest. Ce désastre provoqua la mort de 1 746 personnes dans les villages de Nyos, Cha et Subum, la perte d'un important cheptel ou l'abandon d'une grande quantité de biens matériels. 4 434 survivants furent déplacés suivant les procédures d'urgence et regroupés sous des tentes dans des camps spécialement aménagés à cette occasion. C'était le deuxième événement de ce genre au Cameroun après une explosion identique survenue deux ans plus tôt (1984) dans le lac Monoun près de Foubot, qui avait fait 47 morts.

La période d'urgence fut caractérisée par l'appel du Gouvernement à la solidarité nationale et internationale pour venir au secours des sinistrés et la convocation à Yaoundé d'une grande conférence scientifique internationale en mars 1987 pour élucider les mystères du lac Nyos. L'appel à la solidarité aboutit à de nombreuses contributions sous forme de dons en nature (produits alimentaires, pharmaceutiques, vestimentaires), services (assistance médicale, scientifique, transport, hébergement, manutention) ou de dons en espèces gérés par un comité spécialement créé à cet effet. La Conférence scientifique, elle, draina des savants et spécialistes chevronnés du monde entier (plus de 200), mais ne put donner une réponse satisfaisante à la cause du phénomène. Les hypothèses spéculatives sur les origines des gaz mortels (dioxine de carbone CO₂) s'arrêtèrent aux oppositions ou affrontements traditionnels entre les écoles volcanologiques occidentales, sans dire si l'événement était prévisible ou reproductible. Tout au plus les conférenciers furent d'accord sur le principe de la prévention de nouveaux événements potentiellement catastrophiques, par la poursuite des études et la zonation des risques représentés par les lacs volcaniques et la surveillance de ces lacs. Ils furent également unanimes sur le fait de laisser le secteur Nyos inhabité jusqu'à ce que soit trouvée pour le lac une solution sûre et durable, et de procéder au recasement des populations sinistrées sur de nouveaux sites suffisamment éloignés des lacs de cratère (entre 25 et 30 km).

En l'absence de solutions définitives, les sinistrés resteront sous les tentes pendant deux années durant en bénéficiant de l'assistance extérieure en matière d'alimentation, de soins et d'éducation d'appoint pour près de 2 000 enfants. Le recasement proprement dit commença en février 1988 dans sept villages: Kimbi, Kumfutu, Yemgeh, Bwabwa, Ipalim, Esu et Waindo, tous

situés dans le même département (Menchum). Les critères de choix étaient basés prioritairement sur:

- le recasement des sinistrés de préférence dans leur arrondissement et dans leur chefferie d'origine (Wum et Fundong d'une part, Fungom, Bum et Fulani d'autre part);
- la séparation d'agriculteurs et d'éleveurs en laissant la possibilité à chaque groupe de continuer ses activités (présence des terres agricoles et des pâturages);
- la localisation hors de la portée des gaz de Nyos en prenant en compte la configuration des reliefs ou l'éloignement par rapport au lac dangereux.

Les sites ainsi choisis furent aménagés et dotés d'infrastructures et d'équipement minimum (voies d'accès, écoles, centre de santé, logements de maîtres et d'infirmiers, points d'eau, magasins, moulins, etc.). 413 maisons furent construites avec l'aide des sinistrés eux-mêmes pouvant abriter 356 familles ou 1 870 personnes. Des champs de 2 à 4 hectares furent distribués suivant la taille des familles. L'appui fut apporté aux agriculteurs pour les labours, semences, plants, fertilisants, et aux éleveurs sous forme d'assistance matérielle pour la reconstitution du cheptel (génisses, pâturages, soins vétérinaires). Les agriculteurs répartis en deux clans (Bum et Fungom) et les éleveurs nomades (Fulani) furent parfois installés côte à côte, mais dans des hameaux séparés (cas de Kimbi et Kumfutu) de manière à préserver les spécificités culturelles de chaque groupe.

Mais à l'analyse toutes ces actions hautement positives se sont avérées incomplètes ou ont buté sur des problèmes réels. D'abord, au démarrage de recasement, certains groupes refusèrent de rejoindre le site choisi pour eux par les autorités et préférèrent s'installer sur un lieu dénommé Ndangassi, dans la réserve de faune de Kimbi. Les autorités brûlèrent leurs tentes et les transportèrent de force hors de cet espace protégé pour les diriger vers le village de recasement le plus proche (Kimbi River). Ensuite, les moyens énormes mobilisés en faveur des victimes du désastre et le nouvel habitat doté de confort plus moderne qui fut créé pour elles, finit par produire un contraste saisissant avec les villages autochtones proches. Cela devint un mobile de frustration chez ces derniers qui ne tardèrent pas à transposer leurs ressentiments sur le plan politique en s'estimant être des "laissés-pour-compte" dans la résolution des problèmes régionaux. Il y a enfin les problèmes fonciers dont rien n'indique qu'ils ont été résolus au moment de recasement, les sites n'ayant fait l'objet d'aucune étude cadastrale, et aucun acte d'incorporation provisoire des zones retenues au domaine national avant leur rétrocession n'ayant été signé. L'expérience est encore très récente pour que l'on puisse juger pleinement des niveaux

d'intégration ou de désintégration que cet événement singulier aura permis de réaliser entre les diverses communautés de la région.

Les populations de Njidoum qui ne bénéficièrent d'aucune mesure d'accompagnement après leur sinistre (et les administrateurs locaux) pourraient-elles tirer des leçons des échecs ou des succès des opérations de Nyos quand, pour leur sécurité, elles seront transférées et recasées à leur tour? L'avenir en tout état de cause, reste une quête permanente.

4.3 LES PETITS COLONATS OU LOTISSEMENTS RURAUX

Il s'agit ici d'un ensemble d'opérations de recasement ou l'installation des populations qui ont été menées à l'Ouest-Cameroun entre les années 66 et 70 lors de la mise en oeuvre des projets agricoles ou agro-industriels. Une fois de plus, ces opérations étaient liées au contexte de surpeuplement des hauts plateaux et tendaient à aménager autour des zones les plus saturées des plates-formes de rééquilibrage démographique conformes à la politique de l'aménagement du territoire. Elles ont des points communs avec l'opération Yabassi-Bafang initiée à la même époque, mais s'en distinguent par leur envergure moindre et par leur localisation au sein même du pays Bamiléké. Il s'agit notamment:

1. - du projet MIDERIM (Mission de Développement de la Riziculture dans la plaine des Mbo) devenu plus tard SODERIM (Société de Développement de Riz dans la plaine des Mbo), lancé en 1966-67 dans le but de congestionner les zones surpeuplées du département de la Menoua, et d'assurer rapidement une production intensive de riz;
2. - du projet UNVDA (Upper Noun Valley Development Authority) à cheval entre l'Ouest et le Nord-Ouest, mis en oeuvre également en 1966-67 avec pour but de retenir sur place les populations nombreuses en offrant aux agriculteurs des zones surpeuplées environnantes des facilités d'implantation, et de promouvoir du même coup le développement du riz, du soja, du maïs, des arachides et du poisson;
3. - des lotissements de Mbonda dans les zones de Galim, Bamendjin et Bali en 1966-67 dont

le but était d'ouvrir aux habitants des Bamboutos les terres inoccupées proches du Noun et appartenant traditionnellement à leurs chefferies d'origine. Ici, quelques 200 hectares furent aménagés, délimités en parcelles de 4 hectares chacune et cédés gratuitement aux pionniers. 580 familles environ purent ainsi être installées dans ces lotissements;

4. - des lotissements des Bamendjin A et B ouverts en 1970 aux abords du barrage - réservoir de Bamendjin, avant sa mise en eau qui interviendra en 1974-75. 155 parcelles de 4 hectares chacune furent aménagées et distribuées comme précédemment à près de 500 familles dans cette zone;
5. - du projet "Route du Noun" ou projet agro-sylvo-pastoral du Ndé, identifié en 1970 après l'ouverture de la route Baganté-Foumbot et mis en oeuvre en 1973. En plus de contribuer au désenclavement de la zone identifiée, ce projet devait permettre l'installation d'un certain nombre de pionniers recrutés dans tous les départements Bamiléké, et la mise en valeur d'une bande de terres basaltiques vers la rivière Noun. En 1984, 320 familles environ déjà installées y ont été recensées.

Tous ces projets furent dans l'ensemble des opérations à succès du point de vue social puisque des problèmes d'intégration ne se posèrent nulle part. Non seulement ils répondaient à une demande générée de longue date par la pression démographique et raréfaction des terres dans les hauts plateaux de l'Ouest, mais encore les zones d'accueil et de recasement restaient socialement et culturellement identiques à celles de départ (homogénéité ethnique) en plus de la proximité géographique. L'offre ne put jamais satisfaire toute la demande : moins d'un millier de familles trouvèrent à s'installer dans chacun de ces projets. A l'exception des deux premiers qui furent confiés à des sociétés d'Etat, chaque opération fut réalisée au moindre coût par les promoteurs (publics ou organisations non-gouvernementales). En effet, la nature laborieuse des populations pionnières et leur enthousiasme les prédisposaient à une auto-prise en charge rapide; et les résultats économiques des projets ne tardèrent pas non plus à être établis.

III. POLITIQUE MIGRATOIRE, CO-DEVELOPPEMENT ET INTEGRATION SOCIALE

L'analyse des expériences migratoires enregistrées au Cameroun pose le problème de co-développement à l'échelle locale. Si pour tous les peuples l'autarcie ou le protectionnisme excessif est à la fois cause et expression de mal-développement, le cloisonnement ethnique entre les populations d'un même pays ou d'une même sous-région représente une contrainte majeure à l'expression économique et culturelle. Les mouvements migratoires sont un facteur d'interdépendance entre les groupes pour autant qu'ils sont collectivement assumés. Mais si le principe est acquis, le problème au niveau politique reste tout de même de prendre une option entre susciter ces mouvements, les canaliser ou s'effacer complètement devant leur spontanéité.

1. LES LEÇONS D'EXPERIENCE

Nous avons vu que le Cameroun, pris comme cadre de référence est géographiquement et sociologiquement l'un des pays les plus divers et les plus contrastés en Afrique. Ce contexte en lui-même est générateur de nombreux déséquilibres, besoins sociaux et contraintes dont la migration n'est qu'une des manifestations possibles. Pas moins de quinze expériences (sur une vingtaine évoquées) ont été décrites dans cette étude afin de fonder dans du concret les éléments qui sous-tendent la problématique migratoire.

Nous avons vu aussi que parmi les causes de migrations rurales, la surcharge démographique de certaines régions du pays au détriment d'autres peu ou pas peuplées, les calamités naturelles, les conflits socio-politiques nationaux ou régionaux, la recherche de nouvelles ressources et les réalisations d'ouvrages économiques ou stratégiques, tiennent une place importante. Leurs effets peuvent être combinés et, selon les circonstances, d'autres causes peuvent s'y greffer pour leur donner une vitalité nouvelle. Mais la pression démographique n'est éminemment une cause d'exode qu'en référence à un système socio-économique et culturel donné. Selon les modes d'exploitation ou de tenure foncière, la pénurie peut se ressentir à partir de 50 hab/km² comme dans les zones cacaoyères du Cameroun (cas de la Lékié). Elle peut apparaître aussi bien au delà. Dans les hauts plateaux de l'Ouest, les systèmes agro-pastoraux des Bamiléké autorisent des densités de 150 à 350 hab/km². De même dans les massifs des Mandara, la pratique intense des cultures sur sols caillouteux (terrasses) permet aux gens de vivre à plus de 120 hab/km². Ailleurs en Afrique, on enregistre des densités de 350 à 400 hab/km² dans le district de Kisii au Kenya. Des concentrations analogues se rencontrent dans les zones montagneuses du Rwanda. Dans l'Etat d'Imo au Nigéria, on a dénombré suivant les secteurs 400, 500, 750 voire 1 000 hab/km².

Cependant, les contraintes de densité au départ ont joué un rôle prédominant dans plusieurs formes de migrations spontanées ou organisées : Yabassi-Bafang, Ouest-Mungo, Lékié-Mba, Rive-Gauche du Noun, Mandara-Bénooué, etc...

Au niveau des mécanismes et des effets, un constat intéressant à souligner est la proximité entre les zones de départ et d'accueil dans la plupart des opérations migratoires. Presque tous les colonats qui ont connu un certain succès sont localisés dans la même zone géographique, exception faite des projets Nord-Est Bénoué distants de 300 à 400 km des zones de recrutement des migrants. En effet, plus les nouveaux sites sont proches des villages, cantons ou unités administratives d'origine, plus aisée est l'adaptation ou l'intégration du migrant au milieu d'accueil. Dans le cas des migrations lointaines, le regroupement des pionniers par affinité ethnique ou tribale a été perçu comme une solution palliative au malaise résultant de la distance psychologique d'avec le milieu natal. Mais il en a souvent résulté aussi une singularisation trop étroite des migrants vis-à-vis des communautés autochtones avec un risque élevé de rupture de l'harmonie entre les groupes.

D'un autre côté, on a constaté que les agriculteurs ont toujours constitué la composante essentielle des populations engagées dans les processus de migration rurale. Ce constat est aussi valable pour les opérations de recasement forcé (Lagdo, Mapé, Nyos ...). Il en découle naturellement que les premiers problèmes à affronter dans les projets de colonisation agricole sont presque toujours des problèmes fonciers. Tant que les effectifs de migrants sont encore faibles et qu'il y a suffisamment de la terre non appropriée, la solution est souvent aisée à trouver à travers des négociations directes entre les allogènes et leurs hôtes autochtones. C'est ainsi que dans le cadre des migrations spontanées la question d'intégration entre les différentes communautés est vite résolue, alors que dans le cadre des migrations organisées il faut recourir à une réglementation (lotissement, délimitation, incorporation au domaine national ou étatique, bornage) avant la distribution des parcelles, sans aucune assurance d'avoir prévenu tous les problèmes.

Dans la plupart d'expériences, il est apparu que les migrants étaient en général dynamiques et travailleurs. Démunis à leur arrivée et tributaires des autochtones ou de toute autre assistance extérieure pour leur approvisionnement alimentaire, ils arrivaient rapidement en quelques années à acquérir leur autonomie, animés par une volonté d'adaptation et d'affirmation de soi. Cette labueur, reconnue d'ailleurs par les autochtones sur

lesquels l'effet d'entraînement ne tardait pas à s'exercer, conduisait à des résultats économiques parfois impressionnants: accroissement de la production, élargissement de la base, des échanges, multiplication par dix des revenus en peu d'années (cas SODENKAM et NEB). Il est même arrivé qu'une partie des revenus dégagés dans les périmètres d'accueil par les pionniers soit réinvestie dans les zones de départ (dot, funérailles, construction d'une case, scolarité de jeunes parents, participation aux comités de développement villageois ...) sans que ces derniers soient pour autant coupés des projets locaux (investissements humains, actions coopératives).

Ce sont ces effets mutuellement bénéfiques entre zones de départ et zones d'accueil, entre colons allogènes et autochtones malgré leurs différences socio-culturelles, qui font du phénomène migratoire une expression éminente de co-développement des peuples si de bonnes conditions d'intégration sont réalisées.

2. QUELLE POLITIQUE MIGRATOIRE?

La migration est quasiment un fait social, c'est-à-dire un phénomène inscrit dans la nature des êtres humains vivants en société et entretenant un certain rapport avec des espaces différenciés. En tant que telle, elle a toujours posé des problèmes aux acteurs socio-économiques de tous pays. A travers les expériences qui viennent d'être décrites, on observe en général que quand l'ampleur de la migration est faible et la cause qui l'a déclenchée naturelle, continue et non ponctuelle, ses effets sont relativement insensibles sur les structures socio-économiques ou politiques tant en zone de départ qu'en zone d'accueil. Mais une migration massive et spontanée est presque toujours génératrice de déséquilibres, de contradictions et de perturbations majeures qui peuvent avoir des effets destructurants sur les deux zones. Dans ce dernier cas, les efforts des pouvoirs publics ou institutions tendant à aménager des dispositions appropriées pour sa canalisation viennent toujours après coup pour se greffer à un processus déjà engagé. C'est précisément ce qui se produit lorsque des conflits importants provoquent l'afflux des réfugiés dans certaines régions.

Dans ce domaine, le problème actuel qui se pose à la plupart de pays africains est celui de définir l'attitude politique la plus convenable à adopter suivant les formes de migration et l'intérêt d'une politique migratoire cohérente à mettre en oeuvre dans le cadre d'objectifs nationaux bien ciblés. L'une des préoccupations principales qui transparaissent dans les discours politiques de plusieurs Etats est, sur le plan intérieur, la réalisation de "l'unité nationale" ou de "l'intégration nationale" et, sur le plan extérieur, le franchissement des étapes qui conduisent à l'intégration régionale puis continentale. Dans la foulée des mécanismes économiques et politiques, énoncés davantage dans les déclarations que dans

les faits et nécessaires pour réaliser ces options, la stimulation des mouvements migratoires entre les communautés et les peuples peut en être un instrument privilégié.

Les mouvements migratoires sont plus réels que les discours et n'attendent pas souvent, pour se déclencher, que les politiciens se soient mis d'accord. Les mouvements migratoires trans-régionaux et trans-frontaliers constituent, à l'instar des ethnies et des langues véhiculaires qui dans certaines régions d'Afrique sont à cheval sur plusieurs pays, des facteurs avantageux qui, sagement exploités, peuvent contribuer à l'unité africaine. Les micro-nationalités tout comme les micro-tribalismes, ont bien été dénoncés çà et là, mais seulement en référence à l'histoire, et sans que l'on mette clairement en évidence les "paramètres naturels" permettant de les surmonter.

Les migrations ne constituent pas seulement un lieu d'appauvrissement pour les zones de départ et les difficultés supplémentaires pour les milieux d'accueil. Dans certaines conditions et quelles que soient leurs formes, elles deviennent aussi des facteurs d'enrichissement culturel et économique. Sur le plan culturel, elles favorisent les brassages de populations et d'apports spécifiques qui en résultent et conditionnent l'émergence d'une culture nationale. Les moeurs, les coutumes, les technologies, les habitudes alimentaires fusionnent les uns dans les autres à travers les contacts pour créer un espace culturel plus intégré dont se réclament toutes les composantes de la nation.

Sur le plan économique, elles peuvent permettre à de nombreuses zones apparemment déshéritées de valoriser leur potentiel naturel de richesses inexploitées en constituant pour celles-ci une demande solvable (emplois et échanges). Ainsi en est-il des travailleurs immigrés qui dans plusieurs pays contribuent, tant au niveau de la production que de la consommation, à l'accroissement de la richesse nationale. Il en est de même de beaucoup de régions de départ où les émigrés sont devenus au fil des ans des recours incontournables pour le développement local grâce aux transferts d'une partie de leurs revenus ou bénéfices réalisés ailleurs. Le flux multidirectionnel des ressources entre régions et pays est en partie tributaire des mouvements migratoires et participe à la croissance économique globale. Ces mouvements sont en outre un facteur de rééquilibrage démographique entre les régions, du point de vue de l'aménagement du territoire dont l'un des objectifs est précisément de corriger les disparités naturelles par une redistribution harmonieuse des populations et des ressources sur l'ensemble du territoire.

Dans cette optique, il découle que les mouvements migratoires peuvent être

encouragés, voire recherchés, par les pouvoirs publics. Même les mouvements des réfugiés, n'eût été leur caractère brutal, imprévisible et destructurant pour tous les systèmes, ne seraient pas nécessairement un mal social. La stabilité des groupes tant prônée dans certains discours peut devenir synonyme d'immobilisme économique, voire un facteur de régression. Les migrations seraient alors, à juste titre, un instrument de politique économique, sociale et culturelle à intégrer rationnellement dans les systèmes de planification nationale, régionale ou sous-régionale. L'intégration nationale cesserait d'être un slogan politique pour devenir un concept trans-ethnique et trans-régional, c'est-à-dire un concept qui s'élève réellement au dessus des spécificités fermées; celles-là même qui font que certains citoyens ou homologues de race en arrivent à être considérées comme les "envahisseurs" dans leur propre pays ou région. Ainsi un Ibo ou un Yoruba doit pouvoir se sentir nigérian partout dans son pays sans cesser d'être Ibo ou Yoruba. De même, un Bamiléké ou un Boulou doit se sentir camerounais partout dans son pays sans être obligé de renier ses origines. La même rationalité peut être développée à une échelle plus large.

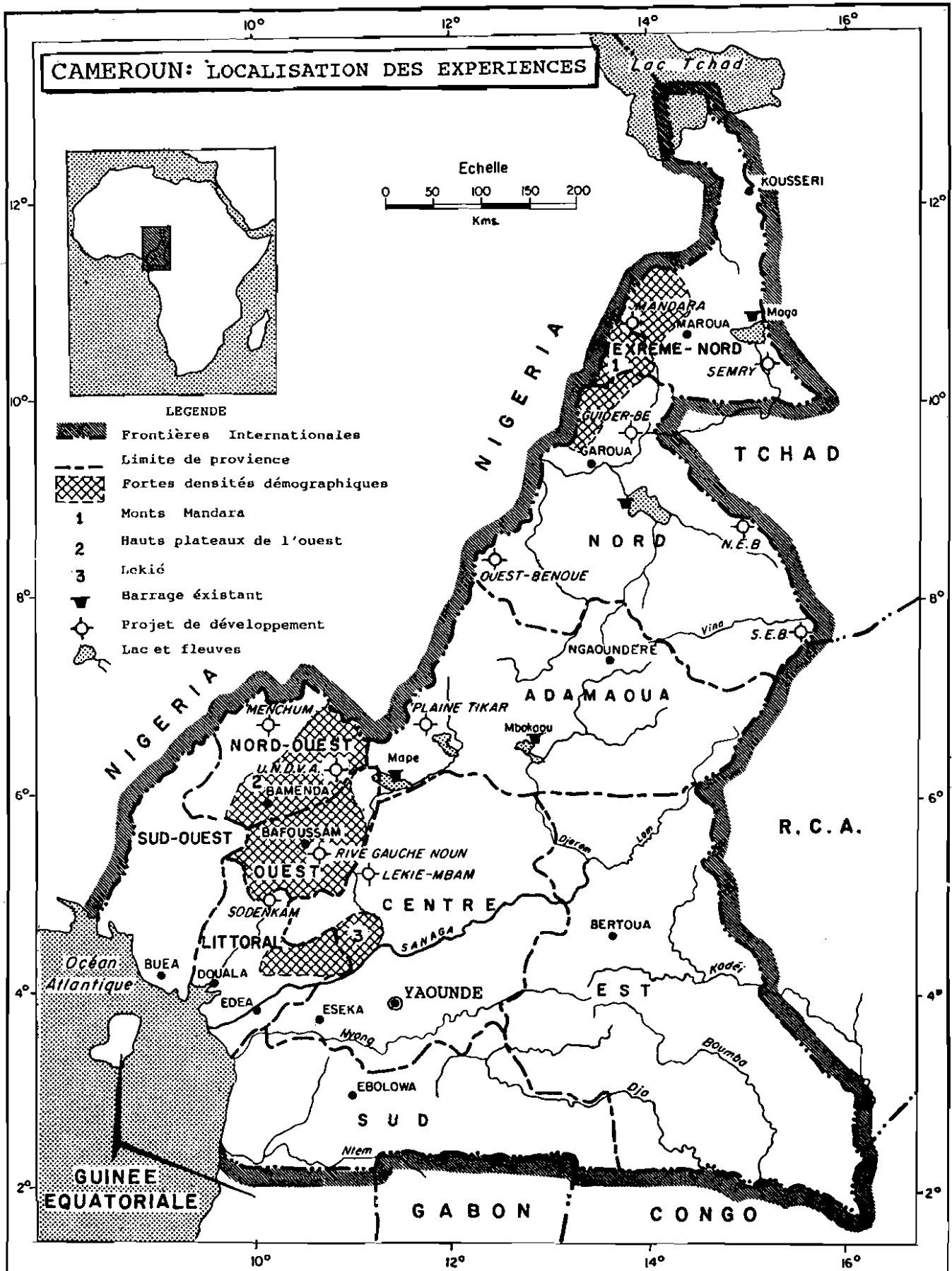
CONCLUSION

Si les mouvements migratoires internes sont à encourager, parce qu'ils permettent aux différentes composantes sociales du pays de s'intégrer et de former une nation, avec une conscience nationale commune et partagée, il reste qu'ils doivent être canalisés pour éviter les risques de nouveaux déséquilibres. Cela suppose au départ que dans un cadre concerté les candidats à la migration soient pleinement avertis des objectifs de l'opération, et que des seuils ou optima démographiques soient définis à l'avance pour chaque pôle d'accueil. Cela suppose également une intervention modérée de l'administration dans

le processus migratoire afin de ne pas bouleverser le rythme des mutations sociales qui accompagnent les contacts, l'adaptation et finalement l'intégration entre les diverses communautés.

Cette intervention peut se résumer dans les études préalables du milieu, la sensibilisation et l'organisation des concertations, l'aménagement du cadre foncier afin de favoriser l'insertion du migrant au tissu économique local, et la ventilation indiscriminée des équipements sociaux à la fois dans les espaces occupés par les migrants et dans ceux où vivent les autochtones. Le cadre institutionnel peut également être réaménagé pour limiter au maximum le cloisonnement entre les groupes et permettre à toutes les communautés quelle que soit leur origine de participer aux affaires locales (élections, associations communes, coopératives, syndicats ...).

En dernier ressort, il s'agira pour les décideurs de ne pas confondre l'intégration sociale, qui est une fusion au niveau des consciences, avec la juxtaposition physique des individus ou des groupes, qui se rapproche davantage d'un *modus vivendi* fait de tolérance relative dans les contextes d'insécurité et de suspicion. La logique des migrations rurales peut-être transposée au plan international en faisant des brassages entre les peuples un instrument de solidarité et de co-développement entre les Etats. Une télé-perception des rapports internationaux supposerait, entre autres dispositions majeures, que les entraves à la libre circulation des personnes et des biens à travers les frontières nationales soient progressivement levées. Malgré certains problèmes réels et inévitables, nous avons relevé de nombreux avantages économiques et sociaux qui pouvaient résulter des mouvements migratoires bien menés; les avantages politiques dans ce domaine aussi restent dans le scénario du possible.



The Appropriate Biotechnology Challenge For African Food And Agriculture In The 1990s And Beyond

by Mr.A. Haribou¹

I. INTRODUCTION

There is a food crisis in Africa. This has been due mainly to the poor performance of the African agriculture. The present trends in food production when viewed in the context of rapid population growth in Africa, cause concern as to the capacity of the agricultural sector to meet present and future food production challenges in the region.

According to FAO data², Sub-Saharan Africa's population is estimated to grow at 3.3 percent per annum between 1985 and 2000 to 675 million. The total demand for all food and agricultural products is projected to grow at 3.5 percent annually between 1983/85 and 2000. In particular, the total demand for cereals, the most widely consumed group of commodities in Africa, is estimated to increase to 100 million tons in 2000. This would increase the deficit between domestic supply and demand to 17 million tons in 2000. The problem of malnutrition is also expected to continue to be severe with the number of people in Sub-Saharan Africa below the 1.2 basal metabolic rate increasing from 105 million in 1983/85 to 137 million in 2000.

These projections and forecasts clearly suggest the nature and magnitude of the food production challenges which African agriculture faces in the 1990s and beyond and substantiate the need and urgency for major improvements in farm productivity. Agricultural research would have to generate the technology for transforming African agriculture to feed the growing

populations, increase exports for foreign exchange, provide more productive employment and raise incomes in the rural areas. Of similar challenge is for such technology to be environmentally sustainable and economically viable, especially for resource-poor farmers.

Can the experiences accumulated in traditional agricultural practices or those gained from the Green Revolution in Asia in the 1960s and 1970s or from Biotechnology or Gene Revolution in the 1980s in the developed countries provide useful lessons to researchers and policy-makers for launching an agricultural revolution in Africa to meet the region's future food self reliance challenges as called for in the Lagos Plan of Action (LPA), the Africa's Priority Programme for Economic Recovery (UNPAAERD) and the African Alternative Framework to Structural Adjustment Programmes for Socio-Economic Recovery and Transformation (AAF-SAP)³

This paper which reviews some major experiences and lessons for african countries from Traditional agricultural practices to Green Revolution, will highlight the implications of Biotechnology Revolution for african agriculture, the need for a Biotechnology strategy for the continent, the Requirements for formulating an appropriate strategy for building national capability and strengthening or developing international co-operation, as a basis to meet food production challenges of the 1990s and Beyond.

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2 FAO. Agriculture: Towards 2000. Revised version 1987, pp.62-70 and 85.

3 Lagos Plan of Action, OAU, 1980.
United Nations Programme of Action for Economic Recovery and Development 1986-1990, (UNA/S-13/AC.1/L.3, New York, 31 May 1986).
African Alternative Framework to Structural Adjustment Programme for Socio-Economic Recovery and Transformation, E/ECA/CM.15/6/Rev.3, 1991.

II. PROBLEMS AND LESSONS FROM AFRICAN TRADITIONAL AGRICULTURAL PRACTICES:

Problems associated with the depressed state of Africa's agriculture occur at both the national and farm levels. In spite of some of the advances known to have been achieved in food production in some parts of Africa, the continent generally, lacks the ability to produce enough food to sustain the population, let alone food production for export. Specifically, there are certain fundamental problems some of which are the following⁴:

Inadequate and misguided Government policies: these include trade restrictions, overvalued exchange rates, taxes, monopolistic marketing practices, unfavourable pricing policies and an overall low priority accorded to agricultural investments;

Lack of effective institution: which is neglected in poor organization and a distressing lack of operations and management control combined with inadequate facilities and equipment to weaken public sector services, such as education, research and extension. Parastatals, particularly those marketing agricultural inputs and commodities, function poorly and depress producer prices;

Lack of pertinent agricultural knowledge: research information in the hands of extension agents is meager and apparently not suitable for small farmers. Technical packages are poorly developed, extension agents are often not properly trained and motivated while interactions between research and extension are almost non-existent;

Unfavourable natural environment: fertile soils in Africa are limited to a few river valleys and high plateaus. The remaining soil is difficult to manage and large acreages are semi-arid. In addition, one finds debilitating diseases and insects that are common only to Africa;

The traditional structure of farming: most farms are small and rely on simple hand tools and human muscle power. Few inputs are purchased. Shifting cultivation, where fields rather than crops are rotated, is the traditional approach to soil conservation and maintenance of soil fertility;

Increasing urbanization and population growth: urbanization has removed labour from agricultural production and changed eating habits in favour of imported foodstuffs. Rapid population

growth rates are increasing overall demand for food relative to the willingness of the agricultural labour force to produce food under current policies;

International economic problems: demand for Africa's agricultural exports has declined and terms of trade deteriorated during this period. Yet prices of imported inputs and consumer goods have all risen significantly. Oil price increases have been ruinous;

Limited infrastructure: roads, bridges and transport are poorly built and maintained.

The historical legacy: agricultural support systems existing before independence were geared toward export crops. Food crops and local livestock were neglected. Moreover, ideas of functional education that were inculcated under colonial regimes - and continued by post-independence governments - have proven inappropriate for fostering economic growth and social development.

Prevalence of numerous diseases: the developing countries of Africa produce reasonable tonnage of grains, roots and tuber crops, grain legumes, plantain and bananas; but over the past years, there have been significant reductions in the yields of these crops due to diseases and pests or lack of improved seeds or other planting materials or lack of the appropriate technologies for mass production, storage and processing. Over 60% of the world's plantain is produced and consumed in West and Central Africa and about 60 million people whose average consumption is 200 or more calories per day depend on this crop as a staple food; but the crop is seriously threatened by a virulent fungal disease called black Sigatoka (caused by the fungus *Mycosphaerella fijiensis*) which is estimated to cause yield losses of between 30% to 50%;

Lack of seeds and other planting materials: a major constraint in increasing root and tuber crop production in tropical Africa is the absence of a well organized seedstock multiplication sector catering to the needs of the farmers. Root and tuber crop growers often produce their own seedstock. Seedstock produced by the farmers are of poor quality, often infested with viruses and nematodes and inadequate for the total demand. In the case of yams it is reported that in Nigeria the cost of

4 J.G. WUTOH, 1990. - Integration of new Biotechnologies into the existing social organization of the countries affected by the food crisis- Paper presented to the UNCSTD/ABN Workshop on Biotechnology for food production in dry areas, Dakar, Senegal, 8-10 October 1990, 20 pages.

seedstock consists of 20% to 30% of the total production cost (IITA, 1984). Yam and sweet potato seedstocks are also stored for 5-6 months before planting. Storage losses are as high as 50% in 4 to 5 months (IITA, 1980). Root and Tuber crop seedstock, therefore, are usually scarce and expensive;

Environmental stress as a major constraint in food production in Africa: optimum environmental conditions for maximum plant growth and development rarely occur in nature. Farmers all over the world, especially in african countries must constantly deal with plant stress avoidance/tolerance for adequate crop yields. Both in nature and on farmer fields, plants are

continuously bombarded with soil (acidity, salinity, alkalinity, compaction, water-logging) and environmental constraints (rain, temperature) that often cause yield instability when uncontrolled. Quite often soil and environmental stresses trigger outbreaks of insects and/or diseases that affect crop yields. Much too often, these unstable yields occur in African countries where food availability means life or death to millions of people.

While there is a degree of variation between African countries, the problems listed above are common to most of them. The cardinal issue facing african policy-makers and biological scientists is how to solve those critical problems that relate to food production.

III. EXPERIENCES AND LESSONS FROM THE GREEN REVOLUTION IN ASIA FOR AFRICA:

The use of high-yielding crop varieties with high levels of chemical fertilisers and irrigation water and adopted as a package under a favourable policy environment underpinned the success of the Green Revolution in Asia⁵. Green Revolution technology, however, focused almost exclusively on grains, especially rice, wheat and maize grown mainly as monocrops. Other staple food crops, such as cassava, potatoes, etc., consumed mostly by the poor hardly experienced any increases in yield through the use of Green Revolution technology.

Although the technology is scale-neutral, government policies on credit, input prices, marketing, land tenure, etc., favoured its adoption more by the rich and large farmers than by the small resource-poor farmers. Also significant was the unevenness in production performance between countries of the region which adopted the same technology.

Important implications followed from the above: small farmers hardly benefited from the Green Revolution. So were those farmers, who cultivated staple food crops other than wheat, rice and maize by-passed by the Green Revolution. The difficulty of applying Green Revolution technology in multi-cropping, use of machines and high levels of fertilizers and pesticides increased the incidence of insect pests, diseases and weed problems and caused serious damage to the environment.

The Green Revolution brought about dramatic increases in grain production and the reduction of hunger in Asia in the 1960s and

1970s. It, however, did not solve the problems of malnutrition and food insecurity. It instead aggravated income disparities and social stratification. Since the 1970s, yields of maize, wheat and rice have stagnated. In fact a major challenge facing Asia since the Green Revolution has been to sustain the high yields attained in well irrigated areas with adequate organization and marketing while improving yields in rainfed, upland and flood-prone areas that were almost by-passed by the Green Revolution.

The important lessons for Africa from the Green Revolution in Asia is that research must develop technologies which not only bring about significant increases in yields but also take into account the needs and circumstances, i.e. the whole environment of the farmer - whether large or small. Since, however, the constraints are more severe on the resource-poor farmer, and especially those in marginal, risk-prone areas in sub-saharan Africa, they should be the central focus of research efforts.

So what are the critical issues for agricultural research and technology development in Africa? It would seem that a more clearly focused consideration of these issues must be viewed within the context of the present state of agricultural research in the region, the technology already available and how well it is adapted to the resources, culture and eco-system of the farmer. It is only within this context that issues regarding new policies, strategies and approaches can be better examined with respect to meeting future food self-sufficiency and food security objectives⁶.

5 B.N. OKIGBO, 1986. *Towards a New Green Revolution: from chemicals to new biological techniques in the Improvement of Tropical African Agriculture*, September 1986.

6 *Feeding the future: Agricultural Development Strategies for Africa*, Casin/Sasakawa Africa Association/Global 2000, Workshop 1989, Accra, Ghana, August 1-3, 1989.

IV. BIOTECHNOLOGY AND AFRICA'S FOOD AND AGRICULTURAL PRODUCTION REVOLUTION:

1. The Potentials of Biotechnology⁷ :

This section focuses on the general aspects of research and development in biotechnology and potential application to African food production rather than on the details of scientific processes. Only the main aspects of the various technologies dealing with plants, animals, microorganisms, and aquatic life will be discussed. The references to literature are thus general in nature and given here to provide a guide for further information.

A. Plant Technologies:

Selection of superior genotypes from existing crops of native populations of plants can provide plants with improved traits in relation to the environments in which they are best suited to grow. New laboratory techniques for selection and evaluation such as Nuclear Magnetic Resonance (NMR) for non-destructive assessment of oil quantity in seeds and gas chromatography mass spectrophotometric (GCMS) analysis of chemical constituents can accelerate the development of improved varieties.

A recent publication of the U.S. National Research Council (1990) describes salt and drought tolerant plants useful for food, fuel, fodder, fiber and other products that are currently or potentially useful in African countries. Stress tolerant selections from plants such as pearl millet (Pennisetum typhoides), saltgrass (Distichlis palmeri) and Argan (Argania spinosa) may be the source of genes for stress tolerance that can be transferred into the genotypes of existing species or serve as sources for genetic transformation of highly valuable crop species.

Because of the natural propensity for plants to produce secondary metabolites or concentrate some of their constituents under stress conditions, plants native to African countries represent a significant opportunity to develop new products for domestic use as well as for export. Some examples are sapogenins from saltbush (Atriplex spp.), essential oils from Mentah arvensis and edible oils from Salicornia europea.

Tissue culture techniques are based on

laboratory studies which showed that cells have a totipotency for regeneration to whole plants possessing all of the traits of the original plant. Techniques have been developed to propagate whole plants from meristem tissues, single undifferentiated cells, haploid cells, and even naked protoplasts (cells with the cell wall removed) on specially prepared media consisting of agar, nutrients, a carbon source and a balance of plant hormones (Vasil 1986)⁸. A clean (sterile) working area and jars or culture tubes sterilized in an autoclave and a growth room or cabinet with suitable temperature control are the basic requirements to pursue the technology. Production is not limited by seasonal restraints as is field culture. Currently most of the commercially important horticultural (Vasil 1986) and forest species (Bonsma and Durzan 1986) have been propagated in vitro using protocols developed for each species and variety.

Some of the applications possible with tissue culture technology include (a) regeneration and multiplication of superior genotypes such as those with drought tolerance without running the risk of losing the superior genetic traits as would be the case if unselected seeds were used, (b) regeneration and subsequent multiplication of virus-free plants such as with potato and chrysanthemum, (c) culture and fusion of protoplasts such as those from a nitrogen-fixing actinomycete and a free-living soil streptomycete, (d) culture of haploid cells from anther tissues in male flowers for creating new genetic combinations that can be further selected in plant breeding, (e) cell cultures for the production of metabolites useful as dyes, flavours, pharmaceuticals and food additives, and, (f) regeneration of whole plants after cells have been transformed by recombinant DNA techniques to make a crop species more productive or resistant to stress. Clearly, the above applications of tissue culture techniques represent various ways in which the technology serves as a tool in plant improvement.

The experience of commercial horticultural nursery companies in the United States is that large-scale propagation in vitro is justified economically only where propagation by cuttings is costly and difficult, where propagation by seeds would involve undesirable genetic diversity, where

- 7 C.M. MCKELL, 1990. *Frontier research and development in biotechnology for food production in dry areas*, NPI Plant Biotechnologies, Salt Lake City, Utah 84108.
- 8 I.K. VASIL, 1986. *Cell culture and somatic cell genetics of plants*. Vol.3. Plant regeneration and genetic variability. Academic Press, New York and London, 1986, p.512.

the end product has a high unit value as in date palm, or where in dioecious crops (species with male and female flowers on separate plants) it is necessary to propagate only female genotypes as in oil palm, jobba, pistachio, etc. Because of the high labour cost inherent in most small, sequential batch tissue culture methods, the future lies in adapting bioreactor techniques for mass propagation of tissues in large containers filled with a liquid media utilizing a stream of filtered air to circulate the media among the tissues. In this fashion the reactor can be operated continuously on a high volume basis until the plantlets are ready for transplant to the greenhouse.

Gene mapping, a technology utilizing DNA analysis methods holds great promise as a tool for accelerating plant breeding and genetic transformation. This technology is based on the ability to identify DNA sequences in chromosome fragments of different lengths that are separated in an electrophoresis gel into characteristic patterns representing genotypic differences according to fragment length. Genetic probes prepared from particular DNA sequences "clone" with homologous DNA sequences from unknown genotypes to permit the mapping of areas of chromosomes or quantitative trait loci (QTL) for important traits.

For example, a map of tomato on which the chromosomal locus for stress tolerance has been determined can be used by the plant breeder to evaluate which of many offsprings from a cross between a highly developed commercial tomato and a stress tolerant wild type contain the desired DNA sequences for stress tolerance (Martin et al. 1989)⁹. Those that lack the desired DNA segment contributing to the trait can be eliminated from further time-consuming field evaluation. Highly developed genetic maps of corn (Maize) and tomato are already available and work is underway to map cotton, rapeseed and other high-volume crops. As costs of laboratory analysis are reduced by refinements in techniques and automation this technology will be useful for breeding plants with better adaptation to arid environments in Africa.

Recombinant DNA technology is the most powerful and basic of all the biotechnologies (Zaitlin et al. 1986)¹⁰. In essence this technology consists of transferring the appropriate sequence of DNA nucleotide bases (the gene) from one organism to another. The process is accomplished by first identifying a source of the genetic trait, "snipping" it out of the DNA strand with an appropriate restriction enzyme and then incorporating the DNA sequence into a vector or

"transfer agent" and then putting the recombinant vector into a bacterial or eukaryotic cell. The bacterial cell, often *Agrobacterium tumefaciens*, can then carry the gene along as it penetrates cells of the target species. Once inside the cell, the DNA sequence may be incorporated into the genome of the target species. Suitable vectors have not been developed for all crop species, especially the cereal grains such as corn and rice.

However, using electroporation or other membrane-permeable methods, protoplast fusion has been achieved which may change the need for vectors. A number of particle bombardment papers have been published in 1990 showing corn transformation with gene expression in regenerated plants. Plant breeders at the Centro Internacional de Mejoramiento de Maize y Tryigo (CIMMYT) have tried several methods involving extracting DNA from a donor corn variety and then soaking corn pollen in a solution of the DNA extract before pollination to transfer genes (as reported in IRRI, 1985). They expect this method to be successful in more distantly related species. A major problem is incorporation of the transferred gene(s) in the genome of the target species and subsequent functioning in the processes of the whole plant.

To illustrate the remarkable potential of recombinant DNA technology, one of the early targets mentioned was to transfer nitrogen-fixing capability from a legume to corn which has a high requirement for nitrogen. This objective is unrealistic because of the loss in efficiency the corn plant would experience if it has to divert energy to support the complete nitrogen-fixing process rather than storing it as carbohydrate in the grain. However, the greatest difficulty is the task of transferring the 17 genes responsible for various steps the host plant must conduct in the symbiotic N-fixing process. The example is further complicated by the requirement for low oxygen levels in cells where nitrogen reduction takes place.

In contrast, the current strategy is to limit the transfer effort to those traits that are controlled by a single gene or at the most a suite of genes located closely on the same chromosome. Some examples of current research and development efforts are to incorporate into commercial genotypes specific genes that control disease resistance, herbicide resistance, insect resistance, oil quality factors, regulation of specific growth stages, and simple stress tolerance mechanisms.

Complete commercial success has not been obtained but numerous single gene transfer

9 MARTIN and al., 1989. Restriction fragment length polymorphisms associated with water use efficiency in tomato. *Science* 243:1725-1728.

10 M. ZAITLIN and al., 1986. *Biotechnology in Plant Science*. Academic Press, Orlando, FL.

projects have been undertaken and results are in various testing stages under careful government regulations dealing with field testing of genetically-altered organisms. Because of the complex multidisciplinary nature of the research required and the elaborate equipment needed to carry out the research, few African countries can successfully pursue recombinant DNA research. Further, many of the crops suited for African land conditions are insufficient in market size to justify the expense of recombinant DNA research.

The best strategy may be to wait for further refinements in techniques that can be applied to low value or low volume crop species. As improved seed products from recombinant DNA technology emerge, some of them may be suitable for use in the African environments. When tailored DNA sequences and transfer systems are in place, substantial improvements may be possible in African land crops at a reasonable cost. Some examples may be improved drought tolerance in *Stylosanthes*, disease resistance in chick peas, or insect resistance in millet.

B. Animal Technologies¹¹ :

Multiple ovulation and embryo transfer (MOET) are relatively new approaches being developed for use in animal improvement. Superovulation may be hormonally induced in a female having the desired traits followed by artificial insemination with semen of a male also having superior traits. The resulting embryos are collected by washing them from the uterus. Subsequently the embryos are frozen in liquid nitrogen where they can be kept for an extended period of time. While in the frozen condition the embryos may be transported to any place they are needed and implanted into surrogate mothers, not necessarily of the same species.

This technology allows opportunities for embryo micromanipulation such as embryo splitting with its potential for genetic research using multiple copies of a given genotype as well as a means for obtaining a higher rate of multiplication of improved animal genotypes for animal breeding than would be possible under traditional practice. It also provides an opportunity to make genetic crosses that would not ordinarily be feasible. By using microinjection techniques it is possible to transfer DNA into the embryo nucleus where it may become an integral part of the embryonic genome. Considerable research is needed to solve problems of DNA fragment integration, persistence of the transferred genes in subsequent cell divisions and animal generations, as well as the applicability in large mammals.

By using semen from bulls with genetic resistance to high temperature, disease of insects common to African countries embryos could be produced from superior cows of other regions and then implanted into surrogate mothers within the environment where improved livestock are needed. The main elements of MOET technology have been developed and are available to be applied appropriately.

Gene mapping is a logical adjunct to MOET. Through the use of genetic probes specific for the Y chromosome, it may be possible to identify the sex of embryos and select males for meat production and females for milk production. Further application of gene mapping techniques provide opportunities to identify DNA fragment patterns associated with desired traits and to use the information to guide breeding of superior individuals adapted to the environments and kinds of feed available in African countries.

Recombinant DNA technologies appropriate to animal production concentrate on biosynthesis of growth hormones using genes from the main food animals to transform bacterial cells such as *E. coli*. The desired growth hormones are then produced biosynthetically by bacterial cells in a bioreactor system. The application of the technology is accomplished through injection of such hormones to regulate growth and animal output efficiency.

Several commercial companies now market growth hormones which can be injected directly into animals or incorporated into their feeds. Other hormonal systems that can be biologically synthesized through DNA technology are currently being researched. Many veterinary medicine products are being produced in bioreactors for use as animal health products. There may be opportunities for developing hormonal controls for animal adaptation to the stresses inherent in African environments.

Bovine growth hormone (Bovine somatotropin) injected into dairy cows has resulted in a 15 to 41 percent increase in milk production depending on the rate and duration of injection (reviewed by Babiuk and Phillips, 1989). This product came on to the market for cattle during 1990. A biosynthetic hormone, porcine somatotropin (PST), is already on the market as a growth hormone for pigs. PST increases feed conversion efficiency by about 25 percent and reduces tissue fat production by almost 70 percent. A vaccine has been developed which elicits the production of antibodies against the Luteinizing Hormone Release Factor (LHRF). The result of

11 BABIUK and PHILLIPS, 1989. *Animal Biotechnology. Comprehensive Biotechnology, First Supplement* Pergamon Press. 260 pp.

injecting the hormone in uncastrated bulls and rams is an increase in the rate of growth.

Given the high cost of animal hormone research and the relatively high volume of research in commercial companies on the subject, it would seem that the best strategy for developing countries would be to stay informed of the progress of such research and to be prepared to test the suitability of products and strategies on animals and production systems that exist in the arid developing countries. In addition to research on genetic improvement and growth/physiological regulation, a major research and development activity is underway in animal veterinary medicine.

C. Microbial Technologies:

Bioreactor culture of specialized plant and animal cells or genetically-engineered microorganisms is a major area of biotechnology research and development. This technology involves production of valuable biochemicals such as hormones, secondary metabolites, non-sucrose sweeteners, and other cellular products in large-volume industrial reactors. Also included in the list of possible bioreactor products could be microbial cultures useful for their biological activities in waste degradation and mineral digestion.

The application of bioreactor or automated culture technology to African countries can only be seen as a part of a larger effort in biotechnology research and development in which particularly valuable plant product(s) unique could be produced by cells in a bioreactor. However, once the necessary high cost research is completed and the processes tested, a bioreactor facility could be established in any location where costs, facilities and market accessibility are favourable.

Microalgae production holds great promise as a means of increasing food supplies (Richmond, 1986)¹². Algal species such as Chlorella, Spirulina, Porphyridium, and Scenedesmus have been studied for their protein, gamma-linoleic acid, pigments and polysaccharide contents in relation to rates of cell growth. Specialty products such as bet-carotene are obtainable from Dunaliella viridis, a microalgae adapted for growth in saline lakes. Culture of microalgae may be as simple as in controlled ponds or as complex as in highly automated industrial vats and reactors. Microalgae can be a source of human food, livestock feed and fish food, as well as a source of speciality chemicals and pigments for pharmaceutical use. However, economic aspects

dealing with volume and value of products in relation to alternatives must be considered in any future research planning.

Nitrogen-fixing microorganisms: Rhizobium spp. have been cultured for many years as symbiotic inoculants for legume crops. Genetically improved cultures of legume inoculants with greater efficiency and specificity for target crops are being developed through selection and DNA transformation. In the 1970's the ability to propagate the N-fixing actinomycete Frankia in pure culture opened the way to utilize the capability of this organism to inoculate non-legume trees and shrubs such as Alnus, Casurina, Ceanothus, and Purshia, some of which are often found in arid lands, in Africa. Other nitrogen-fixing systems involving blue-green algae (Cyanobacteria) and its symbiotic relationship to Azola in rice fields appear as opportunities for biotechnology research.

The biotechnology applications possible with these nitrogen fixing microorganisms include genetic selection and transgenic manipulation to increase their effectiveness in arid lands and host range (Gresshoff 1989)¹³. Improved methods for mass-production are also a priority. In view of the natural deficiency of nitrogen in soils worldwide, any improvements in the nitrogen-fixing process and applicability to cropping practices would be useful, especially to African countries with arid soils of low N-status. Of particular interest may be research on agroforestry practices that utilize genetically-improved nitrogen-fixing trees and shrubs that can be interplanted with food crops.

D. Aquatic Systems:

Aquatic culture systems for the production of food from such aquatic organisms as fish, mollusca, alga and crustaceans constitute a significant opportunity for alternative to traditional crop plant and animal husbandry methods. Construction of ponds on land or retention enclosures in coastal areas provides a means of maintaining feed supply at the optimum and protection from predators and parasites. A full knowledge is needed on the life cycles of appropriate food species such as the Tilapia fish and shrimp in order to optimize conditions and cultural practices for their economic production.

Opportunities to increase production of fish, shrimp and other marine life exist using current and developing techniques whereby food requirements, disease control, growth regulation and genetic selection can be developed that will

12 A.E. RICHMOND, 1986. Microalgaculture. in CRC Press, Boca Raton, FL.

13 P. GRESSHOFF, 1989. Molecular biology of symbiotic nitrogen fixation. CRC Press, Boca Raton, FL. 256 pp.

improve the biological efficiency of food species utilizing appropriate production systems. Biotechnology applications such as transfer of genes for specific traits for disease resistance, growth regulation and nutritional value may make it possible to increase product value and reduce risks for aquatic food systems. Additional products such as biomass for fertilizers and residues for animal feed may be obtained as added benefits from aquaculture.

Aquatic crop adapted to sea water environments can be grown in marine tidal lands to increase food production. Currently the University of Arizona Environmental Research Institute has been conducting research in their laboratories and in coastal tidal lands on Salicornia europaea. Many arid developing countries have

coastal tide lands and marshlands that may be suitable for Salicornia production. This species yields high protein biomass as well as high quality edible oil from its seeds. Biotechnology applications to Salicornia include high-technology methods for selection of genotypes high in oil content and in vitro vegetation propagation of the superior biotypes for use in detailed research on planting, nutrient requirements, harvest and oil quality.

Other plant species that may be cultured are kelp (algae) species, useful for their biomass and extraction of pectins and carbohydrates. Although naturally growing in areas of greater depth than tide lands, kelp species require management for optimal production.

2. The Implications of Biotechnology for African Agricultural Revolution:

Ordinarily, as in the past 100 years, the improvement in crop production in the African context, would be by traditional plant breeding procedures based on the manipulation of the genetic system of the plants through sexual reproduction in whole plants. In recent years a technology for genetic manipulation at the cellular levels has emerged, which has a unique potential for supplementing traditional plant-breeding procedures.

This technology has been developed from advances in the knowledge of cell culture and molecular biology. The technology includes a wide range of potentially useful techniques, any of which utilizes *in-vitro* plant cell and tissue culture for regeneration of functional plants from tissue fragments, isolated cells, calli, protoplasts or embryonic tissue. The term Biotechnology has been applied to this new technology. It is a technology that is receiving a great deal of practical attention in the developed world where food production has already made that part of the world self-sufficient with enough to eat and export.

The subject of biotechnology and its revolutionary opportunities have captured the imagination of the developed world. Indeed, governments and the academic, commercial and development communities of the developed countries are investing large sums of money and human effort to push back the frontiers of knowledge, utilize the new principles to make new products and develop programs that utilize those products in projects to benefit population.

In the broadest sense biotechnology is not new because numerous biological technologies have been used for hundreds of years such as fermentation in the production of wine, bread leavening through the action of yeast and improvement of plants or animals by selecting superior individuals and retaining them to propagate the next generation or using them to crossbreed with existing individuals to produce improved offspring. Scientific understanding of biological constraints have been loosened and the potential for food production is far beyond the

Malthusian limits seen by the last century's demographers¹⁴.

Rather than defining biotechnology in the narrow context of recombinant DNA and bioprocessing techniques (Industrial Biotechnology Association 1984), it should be considered as "any biological technique that uses living organisms, or substances from those organisms, to make or modify a product, to genetically improve plants or animals or to develop microorganisms for specific uses (Office of Technology Assessment 1985)¹⁵. With this definition a continuum of technologies is included in biotechnology ranging from long-established use of living organisms in brewing and biological control, production of vaccines and cell growth regulators, to cell regeneration and recombinant DNA techniques for genetic improvement of microorganisms, plants and animals (Persley, 1990)¹⁶.

The main objective of biotechnology applications in African countries may well be to increase food production. But because of international economic influences coupled with environmental and social constraints, the objectives must be employed in the total context of a country's needs and resources. In a strategy report prepared for the Stanford Research Institute, Hall (1984)¹⁷ outlines three main objectives for plant biotechnology that seem to encompass all of the main reasons for engaging in agricultural research and development.

The first is to improve productivity. By improving the yield potential of a product or crop, it may be possible to increase production over the amount currently obtained and thus gain a return on the investment for research and development still utilizing the same levels of land, manpower and resources. In the scale of importance for African countries, increasing yield is the highest priority, especially in stress environments where existing crop and animal yields are constrained by unfavourable environment.

The second priority is to improve quality. By improving the quality of an existing product it may

14 The Limits to Exponential Growth, Chapter II of The Limits to Growth, A Report for the CLUB OF ROME'S project on the predicament of mankind, 1974, p.45-86.

15 Office of Technology Assessment, 1985. Innovative biological technologies for lesser-developed countries. US Government Printing Office, Washington, D.C.

16 G. PERSLEY, 1990. Harnessing biotechnology for the third World. Pages 7-11 in Partners in Research for Development, N.3. The Australian Centre for International Agri. Research, Canberra, Australia.

17 P. HALL, 1984. The role of biotechnology in the genetic modification of higher plants. Report N.1. Stanford Research Institute Proj.7091. SRI International, Menlo Park, CA.

be possible to increase products or by increasing its content and uniformity of constituents. Whatever the improvement strategy the end result must be to increase consumer preference over unimproved products. Quality is essential for products from developing countries to compete in world markets.

The third priority is to reduce the cost of production by improving internal biological efficiency, increasing the ability of the organism to function in existing and marginal production environments or to improve the efficiency of response to cultural practices such as fertilization, nutrition, irrigation and use of pesticides.

Some special constraints of biotechnology are important to consider in assessing their applicability to improving food production in African countries. Too often these factors may be ignored in formulating program goals and expected results. Briefly, these constraints are: (i) research is expensive and may not always result in marketable products; (ii) time is required to solve complex research problems; (iii) commercialization of products requires coordination between research and development teams as well as adequate incentives and proprietary protection; (iv) solutions to problems often involve inputs from both public and private research and development sources.

In contrast with the Green Revolution which mainly concentrated on information from the public sector about appropriate cultural practices necessary to improve the production of new high yielding plant varieties, the Biotechnology Revolution or Gene Revolution, concentrates on a wide range of products mainly from the private sector such as seeds, inoculants, biopesticides, improved plants, and growth regulating hormones for animals, many of which are being developed for commercial markets (U.S. General Accounting Office 1989).

A large share of the research is being done in commercial laboratories with the objective of marketing products under patent protection. An important point to consider is that these new products must meet market competition and to be successful they must be superior in quality and be available at a price that represents their extra value. While some may view this commercial protection as a threat to the time-honoured tradition of free

information through agricultural extension, others may view the commercial influence as an extra benefit and opportunity to work with many new and improved products. Those who are not comfortable with commercial exploitation of biotechnology companies for research and testing there might not be as many opportunities to obtain the benefits from new discoveries in biological science.

A valid criticism of the commercial companies is that they only work on those product opportunities that have substantial market volumes and profit margins whereby they can recoup their expenses. The unfavourable aspect of this situation is that some of the low volume, low margin, or non-market products common to developing countries are ignored. This problem may be partially solved by the international research institutes and public institutions assuming a greater role in improving crops of low market volume but for which there is a great societal need.

Given that this assessment deals with the opportunities for applying biotechnology to African countries, a reminder seems necessary that Africa lands have severe constraints to production of food. In addition to the obvious environmental stresses of drought, salinity and temperature extremes, there are others associated with such conditions as low national incomes, inadequate infrastructure and utilities, limited availability of investment funds, and traditional agricultural conservatism.

Whether new biotechnologies are developed within African countries to meet their specific needs or suitable commercial products are adapted from international sources, the results may well be the same. The more important issue is whether any strategies or products are available at all to meet the special requirements of African lands in order for people to maintain acceptable levels of nutrition and health.

The objectives of the following section are to briefly examine the potential of biotechnology dealing with plant, animal, microbiological and aquatic technologies, especially those that can be applied to problems of African lands. It will also examine some of the physical, environmental and economic issues and to propose some agenda items for applying biotechnology to African countries.

3. The Need for a Biotechnology Strategy for Africa:

African countries where the food crisis is most felt in the world have as a primary goal the improvement of their food-production capabilities. In general, they need to economically and efficiently increase production per unit of land as well as to expand the land areas suitable for agricultural production.

All technologies and all agricultural systems that can increase productivity per unit of input, therefore are of interest to African countries. Biotechnology, that has helped to advance agricultural production research and has advanced commercial production in developed countries in the past ten years is uniquely able to increase agricultural productivity, and must be embraced in the developing countries of Africa.

Biotechnology has been used as a means to bypass or traverse in a shortened time, certain stages in agricultural development. African countries must be concerned and are indeed concerned that delay in adopting this latest aid to agricultural production might put them even further behind the industrial nations in agricultural production capabilities.

The introduction of biotechnology to African countries promises both considerable benefits and the risk of significant dislocations for them. The challenge is to give a decisive momentum to activities involved in the sustainable development and application of biotechnology for African countries and to avoid any adverse side-effects such as loss of germplasm, displacement of exports, negative impact on the labour market, etc.

Unfortunately, African countries have already begun to experience the negative impact of substitution processes to which applications of biotechnology give rise; for instance, cocoa butter production through tissue culture or via enzymatic transformation of palm-oil and the manufacturing of plant secondary metabolites such as fragrances, and flavours constitute a serious loss of exports earnings for African countries.

At the present time commercialization of biotechnology, as with all other innovative agricultural activities, because of its capital-intensive nature and international competition, leads to ever-increasing dependence on private sector R&D investment. Securing returns on investment is conducive to privatization of know-how and to pressures for stringent regulatory mechanisms (patenting).

Whilst African countries cannot prevent such applications of biotechnology advances in the industrialized countries, they can, at least, limit their negative impacts. This presupposes the virtual discontinuation of Africa as a trading partner and supplier of raw-agricultural materials to industrialized countries, and the creation of a self-contained African regional market within which autonomous and authentic development can be pursued. Africa would have to move away from the mass of false assumption which have, up to now, dominated the development thinking of the continent.

The preceding short description of positive and negative considerations pinpoints the need for the adoption of innovative strategies and mechanisms to effect the introduction of biotechnology in African countries. What kind of international co-operation should be foreseen in this case? Development or Transfer of biotechnology in Africa is not only hampered by the inadequacy of financial resources but by the insufficiency of mechanisms to analyze global technology trends, inadequate science and trained manpower, unfavourable legislative and socio-economic frameworks.

Within this context, African strategy should include both the provision of direct support for biotechnological research and the fostering of a climate where biotechnology can thrive - or not thrive, as the case may be. A large part of that climate will depend on a governments' policies for building national capability and strengthening or developing international co-operation.

V. THE REQUIREMENTS FOR FORMULATING AN APPROPRIATE STRATEGY:

Biotechnology constitutes a set of novel tools and techniques that enable scientists to manipulate the core of all living organisms (ADN) leading to the expression of enhanced or even totally new properties in plants, animals and microbes. Recent developments in biotechnology have opened up opportunities for the application in many areas. They include some of the most significant sectors, particularly in the context of African countries: agriculture and animal husbandry.

In fact, economic performances in Africa during the last decade has been disappointing and the prospects for agriculture, especially in sub-sahara Africa remain unfavourable and there is concern that food crisis may tend to become endemic. While Africa still needs to import large quantities of food mainly cereals, world market prices for major African agricultural commodities have been falling.

Nevertheless, biotechnology techniques offer possibilities to African countries to substantially increase their food production. In this regard, ways of transferring biotechnologies to African countries should be studied carefully and judicious cooperation with Multi-national Corporations and International Research Centers encouraged.

African countries must decide whether or not they wish their agricultural sectors to evolve along the path that the twin determinants of **appropriation** and **substitution** have marked out for the industrialized countries.

Such a course of action can only be adopted unanimously by the countries of the continent and will call for concerted efforts to determine the biotechnologies which are acceptable, and the ones which should be rejected. Obviously all substitution aimed applications are suspect *a priori*, whilst appropriation reinforcing applications can be adopted with suitable arrangements to minimize the undesirable side effects on the rural population.

The task of establishing national policies aimed at strengthening or developing those biotechnologies, and their applications, is to bring about an increase in food production. There is a

need for careful screening of available biotechnological options and their applications in order to identify their ultimate effects on the economy in general, and the rural sector in particular, in all their ramifications. This shifting and taping of biotechnologies requires the collaborative work of skilled manpower that can best be done at an intergovernmental level. Of course, final policy decision must be taken at national levels taking into account the particular circumstances and objectives.

Failure to take appropriate steps to orient national policies with respect to biotechnologies which could enhance sustainable agricultural development will mean that Africa's future will be determined from outside the continent.

This is why it is absolutely necessary for Africa to have a strategy for biotechnology to assist the Continent to set up national capability and appropriate international cooperation :

1. Building national capability :

The strategy to build national capability in biotechnology to serve national goals should include the following elements¹⁸:

(i) The political will :

Governments should accept and commit themselves to the development of biotechnology. In fact, contrary to developed countries where biotechnology research is controlled by the private sector (Multinational corporations)¹⁹, Governments will have to play a very important role in the transfer of biotechnology in Africa. Furthermore, if biotechnology in Africa is to be geared to the improvement of agricultural productivity at the small farmers' level, this could be done only by the public sector.

Also most biotechnologies in developed countries are oriented to the production of substitutes to export commodities of the developing countries, including those of Africa. Solving the food crisis in Africa should be one of the main objectives of biotechnology transfer. This can be done only through government intervention. In short, Governments should be willing and committed to the development of

18 The demand in Africa for Biotechnology for food production: a keynote address by Dr. Edroma, Eric L., ABN/CSTD Workshop on Biotechnology for food production in dry areas, Dakar, Senegal, 8-10 October 1990.

19 R.D., CAPE, 1986. Future prospects in biotechnology: a challenge to US leadership. In *Biotechnology in Society: Private Initiatives and Public Oversight*, ed. J.G. Perpich, Pergamon Press, New York.

biotechnology so that appropriate supportive inputs can be provided to necessary biotechnology programmes to be prepared.

(ii) Formulation of appropriate policy :

It is necessary for each African country to determine its priorities with a view to identifying its economic objectives and drawing maximum advantage of available resources.

In this regard measures should be taken to formulate an appropriate policy framework for biotechnology. Such framework should include:

- the setting up of broad objectives and goals of the national biotechnology programme and broad policy for managing access to relevant biotechnology;
- the definition of the relative roles of public and private sectors in research and development, commercialization, as well as policy regarding intellectual property rights;
- the introduction of inventor certificates in order to maintain the nature of biotechnology-based innovations as a public service and recognition of researchers;
- the establishment of guidelines for biotechnology research and development with due attention to safety and environmental consideration;
- the establishment of the organization machinery to implement the national biotechnology programme.

(iii) The Identification of priorities :

Research priorities in biotechnology are currently determined by commercial prospects. Biotechnology can be fruitfully employed to develop varieties which require lower inputs of agro-chemicals such as fertilizers, pesticides that would be more appropriate for millions of small and marginal farmers in Africa.

But instead of developing such varieties, seeds resistant to proprietary pesticides, have been developed hence making them more dependent on chemicals. These trends, therefore, suggest that the pro-poor potential of biotechnology may not be used.

African countries should, therefore, identify thrust areas and priorities, and specific well defined research targets in view their development objectives, available resources, capability and technological feasibility. In short term, African countries should concentrate on building

capabilities in well established, proven and relatively simpler techniques, mainly those leading to increased agricultural productivity through tissue culture, or increased efficiency in food processing.

Since they are mostly poor agrarian economies, eradication of poverty, hunger and malnutrition are the most pressing problems of African countries. Therefore, agriculture, food and bio-energy based rural industrialisation would appear to be most promising areas of application of biotechnology.

In African countries, priorities in biotechnology programmes should attach importance to the development of low input sustainable farming systems to benefit marginal and small farmers. These farmers operate generally at the subsistence level and are naturally risk-averse. However, it is likely that the acceptance of new varieties will greatly improve, if they are developed in cooperation with local farmers, using their knowledge to improve local farming systems.

(iv) Human resources development :

One of the most serious constraints hindering development of biotechnology is the complexity of the discipline. Sub-Saharan African is in acute shortage of trained and experienced endogenous manpower. This region may have no more than 400 biotechnology researchers and technicians widely scattered, and far less in the dry zones. This total compares poorly with USA with 23,000, Japan with 3,400, and Latin America with 1,900²⁰.

African Governments should as a matter of urgency start multidisciplinary training programmes and integral approach for raising the level of the badly needed biotechnology researchers and technicians at all levels.

Training of scientific and technical manpower is the most crucial element of a strategy to build local capacity. In the immediate future, African countries should train enough biotechnologists abroad while taking action to create strong faculties of well qualified experts in interrelated disciplines that constitute biotechnology in local universities.

In African countries the diffusion of research results has often been a bottleneck in the adoption of new technologies. In the case of biotechnologies care must be taken to ensure speedy and effective diffusion of technologies. This is possible through the training of extension

20 Please refer to page 9 of Dr.EDROMA's "A keynote Address", footnote 16/.

workers, who will form the linkages between biotechnology programmes and rural development agencies.

In addition, because of the rapid progress in biotechnology, access to basic scientific information is needed. But, given the trade secrecy of biotechnologies by multinationals, the flow of this information through usual channels will remain very restricted. Therefore, alternative sources of information through network systems, joint venture programmes, have to be developed.

There is an urgent demand for establishing and equipping national Universities and Research Institutes for development and promotion of biotechnology. The degree and graduate courses must be structured and specialist training developed. This inevitably requires direct involvement of the public and private sectors and the co-operation with foreign Corporations and International Agencies. The training should be introduced right at the undergraduate level as part of classical biological disciplines (such as microbiology, biochemistry, physiology, genetics, etc) and pursued aggressively in depth at the postgraduate level.

Regional and International cooperation is needed for promoting biotechnology transfer as a means for realising its potential in reversing the current pathetic situation of malnutrition, hunger, famine, diseases, poverty and death. The continent must produce a strong team of geneticists, biochemists, physiologists, microbiologists, industrial chemist, biotechnical or process engineers, plant and animal breeders, laboratory technicians, and a wide range of other medium and high-level specialist to maintain the equipment of the facilities.

Establishment of biotechnological Centres and research teams inevitably requires heavy investment and availability of foreign capital, which national governments may not afford readily. Through International cooperation and support and encouragement of twinning of high education and research institutions, biotechnological Centres can be established and maintained, joint advanced training programmes and investigations undertaken, International Biotechnology Network established, biotechnology database and information exchange services developed, and advice in formulating national policies and programmes in biotechnology provided to governments. The international cooperation in biotechnology with UNESCO, FAO, WHO, UNIDO and other interested Agencies should be renewed and strengthened.

2. Strengthening International co-operation:

Regional and international cooperation is certainly one of the means of promoting

biotechnology transfer to Africa. Regional and international cooperations can in fact be set up to study common problems, carry out joint research projects and obtain results applicable to countries within a region or subregion.

Such cooperation has the advantage of involving industrialized and developing countries within the framework of bilateral or multilateral agreements, as well as private institutions including multinationals. Joint ventures and co-financing of projects by public or private nationals and international institutions are better ways of sharing technological know-how.

As far as African countries are concerned, while making great efforts to train experienced scientists and highly qualified engineers, they would in the short run depend on licensing inventions and collaboration with multinationals until they are able to build up their own centres and research teams.

In fact, a fruitful cooperation needs to be established between African and industrialized countries to mitigate the effects of technical secret and harsh competition for the appropriation of biotechnologies through patents and exclusive exploitation rights. Cooperation with reciprocal benefits will no doubt contribute to an equitable distribution of returns from the application of biotechnologies.

Nonetheless, cooperation in the field of biotechnology, among African countries is very important since it enables :

- the undertaking of research programmes of common interest jointly to avoid duplication and save scarce resources;
- the pooling of resources and capabilities, which may enable African countries to undertake projects they might not be able to do individually;

Given the initial high cost of investment needed for infrastructural facilities, African countries will stand to gain by pooling their resources to create regional or subregional research and/or training centres rather than embarking on the establishment of poorly equipped and inefficient national institutions. The latter should be strengthened to carry out adaptive research using the results of the former.

CONCLUSION

Although Africa's food crisis is afflicted with problems associated with traditional agriculture practices essentially characterized by colonial, political, social, structural, economical, technical and environmental factors, the cardinal issue facing african policy-makers and biological

scientists is how to solve those critical problems that relate to food production.

Concerning the Green Revolution which succeeded in Asia, the important lessons for Africa is that research must develop technologies which not only bring about significant increases in yields but also take into account the needs and circumstances, i.e. the whole environment of the farmer - whether large or small. Since, however, the constraints are more severe for the resource-poor farmer, and especially those in marginal, risk-prone areas, they should be the central focus of research efforts.

So what are the critical issues for agricultural research and technology development in Africa? It would seem that a more clearly focused consideration of these issues must be viewed within the context of the present state of agricultural research in the region, the technology already available and how well it is adapted to the resources, culture and eco-system of the farmer. It is only within this context that issues regarding new policies, strategies and approaches can be better examined with respect to meeting future food self-sufficiency and food security objectives²¹.

Biotechnology offers several interesting opportunities for achieving self-sufficiency in food. In plant production, biotechnology can contribute to improved nutrient availability and to control of pests and diseases, providing disease-free seeds which can be high-yielding, pest resistant and which can stand harsh environmental conditions. Biotechnology can also contribute to an improved local processing of agricultural raw materials through fermentation.

In animal production, appropriate biotechnology can improve livestock production in farms of all sizes in three ways: Firstly through improvement of animal nutrition, secondly through improved animal health and thirdly improved animal reproduction.

Although genetic engineering of plants and animals may be feasible today, the major benefits are likely to emerge in the future. However, application of a particular biotechnology to agricultural or animal production must be carefully considered. Since current agriculture has concentrated on the large-scale farming systems, agricultural biotechnology may be more readily and easily adopted by large-scale producers than by the small-scale farming systems. It is therefore essential to develop specific criteria for the selection, introduction and application of biotechnological innovation to be able to improve

food production at both the small-scale and large-scale farm levels.

For Africa, the main choices are between:

- the progressive relegation of African agriculture to a peripheral role in a free trading world in which capital and technological expertise are concentrated in the North, Africa becoming a producer of cheap biomass and a consumer of the products of an international consumer industry. African labour may also contribute to the international biotechnological transformation process a proportion of which may be located in the continent close to sources of raw materials and cheap labour;
- disconnection of the continent from the international markets, by appropriate and sustainable in-house technology and/or technology transfer, of an autonomous food and fibre processing industry following the evolutionary pattern of agro-industrial development which has already occurred in industrialized countries;
- the development of a self-centered, indigenous agro-industrial economy among participating African countries, through selective and deliberate transfer and adoption of industrial, chemical and biological technologies from the industrialized world, in which ownership and participation of the rural base would be ensured by innovation policies. Judicious collaboration of transnational corporations would be obtained to bring about the capital and technology transfers necessary to the development of self-sustaining and authentic economies.

However, to exercise its choice, a mechanism must be created for the study and presentation of the options to African member States so that the latter may select the most suitable policies designed to bring about the desired end. Building national capability and strengthening international co-operation should characterize the African strategy.

Building national capability for Biotechnology Revolution means: - political will from African Governments which should accept and commit themselves to the development of biotechnology which can be considered as a tool for food production; - formulation of appropriate policy to the improvement of agricultural productivity; - human resources development by training manpower, by establishing and equipping

21 Feeding the future: Agricultural Development Strategies for Africa, Casin/Sasakawa Africa Association/Global 2000, Workshop 1989, Accra, Ghana, August 1-3, 1989.

national or sub-regional and regional Universities and Research Institutes for development and promotion of biotechnology.

Regional and International cooperation are needed for promoting biotechnology transfer and a means for realising its promises in reversing the current pathetic situation of malnutrition, hunger, famine, diseases, poverty and death. Through International cooperation and support and encouragement of twinning of high education and research institutions, biotechnological Centres can

be established and maintained, joint advanced training programmes and investigations undertaken, International Biotechnology Network established, Biotechnology database and information exchange services developed and advice in formulating national policies and programmes in biotechnology provided to governments. The international cooperation in biotechnology with UNESCO, FAO, WHO, UNIDO and other interested agencies should be renewed and strengthened.

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Food Security In Africa: An Empirical Assessment

by Prof. G.O.I. Abalu¹

SUMMARY

This paper reports on an attempt to assess the food security situation in African countries. It begins with a review of the concept of food security and its relevance for understanding the on-going food crisis in the continent. The paper then assesses and ranks the food security situation in each country on the basis of a constructed Food Insecurity Index (FII). This index not only provides an indication of the relative food security situation in each country, it also provides an appreciation of the efforts already made by African governments and a basis for assessing the magnitude of the task that lie ahead.

I. INTRODUCTION

In 1983 a United Nations Committee on World Food Security defined the objective of food security as the provision of assurance "that all people at all times have both physical and economic access to the basic food they need" (FAO, 1983). In specific terms and at the global level this would involve: ensuring adequate production of food; maximizing the stability of food supplies; and ensuring access to food particularly on the part of those in greatest need.

This concept of food security now informs current thinking on the subject which lays emphasis not only on food availability through domestic production, storage and trade, but also, and perhaps more importantly, on access to food through home production, purchase in the market, or food transfers. This approach to food security gives emphasis to food "entitlements" such as land, credit, income, and family support systems, a new analytical dimension to food security pioneered by Sen (1981) in his work on famines. The approach also provides a new awareness of the importance of women's contributions to both household and global food security.

Underlying this approach to food security are two assumptions, not in themselves new, but until recently, not given sufficient attention by policy makers in many African countries. These assumptions are that: (1) a distinction must be made between permanent and temporary food insecurity; and (2) famine, hunger, and

malnutrition are, in most cases, as much a problem of poverty as of shortage of food supplies.

Temporary food insecurity is the result of short-term fluctuations in production brought about by fluctuations in household incomes, food consumption, and in the availability of food at the national and global levels. Temporary food insecurity is thus a manifestation of temporary lack of access to sufficient food and can therefore be eliminated or drastically reduced by corrective stocking policies. Whenever enough supplies of food to go around is available at the global level, the problem of temporary food insecurity in the African context must be seen largely as one of ability to buy and the important variables here are the magnitude of instability in international prices and the average levels of real incomes prevailing in the economy. Permanent or structural food insecurity, on the other hand, represents a state of continuous inadequate access to food and is due to a long-term structural deficiency in production and chronic inadequacy of purchasing power.

It is also now generally accepted that the problem of food insecurity is not just about food alone but also about the general problem of poverty and unequal distribution of purchasing power among and within regions. Famine, for example, represents the most severe form of temporary food insecurity manifesting itself in a sudden collapse of food consumption and dramatic increase in the incidence of diseases and death. Because famine is caused by a variety of factors including crop failures, natural calamities such as floods, and sometimes, high food prices, it often occurs without substantial reduction in food availability per head or even in the face of food exportation from the affected region.

Although the current level of poverty is quite significant in most developing countries of the World and although most of the developing world economies performed relatively poorly during the seventies and eighties and Africa appears to have been equally affected by the prevailing conditions, the increasing levels of poverty in African countries in the 1980's portrays a disproportionate slump into economic morass.

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Available evidence leaves no doubt that the continent is suffering from a severe crisis in food production manifested by widespread decline in per caput food production over the last two decades. As food production has failed to keep pace with consumption requirements, ever increasing levels of food imports, including food aid, have been used to try to keep up with per caput dietary energy supplies. The crisis reflects a generally declining trend in food production as well as a declining ability of the citizens of African countries to purchase food. Unless these trends are reversed, the continent is heading for an even more serious food security crisis. The implications of this outlook in terms of human misery, political turmoil, and economic stagnation could be quite serious. A persistent situation of food insecurity takes its toll in growing pools of undernourished citizens amenable to political instability which, in turn, leads to economic instability and stagnation.

Because agriculture forms the principal activity in their economies both in terms of the occupational distribution of the labour force and in terms of its proportionate contribution to the Gross National Product (GNP), inadequate food and agricultural production also pose serious overall economic problems for African countries. Governments of the region have responded to inadequate local production of food by increasing the level of food imports from the developed countries.

During the seventies and eighties the absolute levels of food imports into the region increased dramatically (FAO, 1989a). Over this period, the share of cereals in the total food import bill also increased markedly, representing an increasing preference by citizens of the area for wheat and rice. As incomes have increased and relative prices have changed, rice and, to an increasing extent, wheat for bread, have reduced the relative interest in traditional African grains such as sorghum, millet, and maize as well as interest in non-grain substitutes such as yams, cassava, and plantains.

While in the sixties and seventies low grain prices coupled with concessional sales made

imports a quick and less painful way of meeting food gaps, the situation changed dramatically towards the end of the seventies when the cost of Africa's cereals imports increased dramatically. The vagaries of the cereals import situation is brought about by the fact that most of the trade in cereals takes place between the subsidized countries who have intrinsically subsidized production for exports during surplus periods and stepped ahead of others to purchase higher priced grains during periods of scarcity.

Steadily declining food production and precarious levels of food imports are unmistakable indications of increasing levels of food insecurity. The political costs of increasing levels of food insecurity in Africa are quite enormous. The consequences of persistent levels of food insecurity on the political security of African countries are now very well known. Wars, coups, and violent uprisings can often be traced to the level of food insecurity and human sufferings in these countries. These disruptions often have lingering repercussions which continue for a long time to work against even well meaning efforts to reduce the sources of the problem.

The enormity of the food security problem in Africa has prompted a number of African governments and international agencies to initiate projects and programmes aimed at getting adequate food to the peoples of the continent. However, for these projects and programmes to positively influence the incidence of food insecurity in the continent, the food problem in each country must first be examined in relation to the extent to which an adequate level of food security is being attained. Such an assessment would give precision to the shortfalls in food production and accessibility to food vis-a-vis the ultimate goal of food security.

This paper is intended to provide a basis for such an assessment and to serve as a guide for appraising the effort made in each country so far to attain food security and for estimating the magnitude of the effort that would need to be made in future, to attain the target.

II. ASSESSING THE FOOD SECURITY SITUATION IN AFRICA

Periodic but regular continent-wide consumption surveys represent an ideal way of assessing the food security situation in Africa. However, taking into consideration both logistic and cost considerations, these kinds of surveys appear unfeasible at the present time. Alternative ways of measuring the level of food insecurity in the continent must therefore be explored.

Ideally, the measurement of food insecurity in Africa has to take the variability of staple food production, the degree of preparedness of countries to foresee and cope with widespread and acute food shortage and their ability to obtain access to commercial food stocks on the world market, into consideration.

All early attempts to improve food security have concentrated on stocking and import policies for food grains, principally cereals (and predominantly wheat) and those foodstuffs have been the principal component of emergency aid. It must, however, be recognized (and is increasingly so recognized) that, for several reasons it is not appropriate to limit the foodstuffs considered in assessing food security in the case of most African countries, to cereals, or even to grains in general. The cereal portion of the staple diet in most African countries is not as important as it is in Asia, for example. In some countries in Africa the cereal portion of the diet is so low as to make assessment of the food situation based on cereals alone entirely inadequate. Available evidence clearly suggests that any assessment of food insecurity in Africa must take into account roots and tubers, nuts and oilseeds and fruits (which includes plantains) and in certain countries even alcoholic beverages (FAO, 1984).

Ideally, therefore, a quantitative assessment of food security in African countries should include other food items besides cereals. However, limitations in the availability and quality of data on other staple food consumption besides cereals usually render the inclusion of other important food items in the analysis of food insecurity, impractical.

The three main components of food security can be summarized as follows (FAO, 1989a):

Adequacy of Supply

1. Production level
2. Reduction of post-harvest losses
3. Import level
4. Export level

Stability of Supply

5. Production stability
6. Interzonal price stability
7. Intertemporal price stability

Access to Supply

8. Adequacy of consumption in the insecure zones
9. Adequacy of income in relation to food prices
10. Access to employment

The fact, however, is that, nations, in assessing their food security situation, do not usually examine these component parts in isolation but usually require an overall indication of the food security situation in their countries. This therefore makes the construction of a composite index of food security and the definition of a typology of countries with respect to their food security situation, a useful exercise.

The non availability of requisite statistical data on these components makes such an exercise quite difficult. Also given the wide range of indicators of food security involved, it is easy to see why one quickly runs into a methodological road block in comparing the status of food security across countries and in predicting the probable food security situation in the country in the future. One consolation, however, is that, the inclusion of all of these indicators in the construction of a composite index of food security may not be entirely desirable as the outcome may be too complex to be useful.

Constructing a Food Security Index

The exercise of constructing a food security index for each of the countries of Africa has borrowed from the effort of the UNDP to construct a human development index for countries of the world. As in that effort, the preferred approach in the construction exercise is shortfall as opposed to attainment. There are several reasons for this preference. First of all, as defined in this report, the attainment of food security is a target which once achieved and maintained becomes redundant. In other words, because the attainment of food security is an end in itself, it is irrelevant to talk about degrees of food security. Instead, it is more relevant to talk of levels of food insecurity as indicating a shortfall from some acceptable or achievable target. Such a measure will not only provide an appraisal of the effort made in attaining a targeted level of food security, it will also emphasize the magnitude of the effort that would need to be made to attain the target.

Although several indicators of food insecurity exist, the construction of a food insecurity index for countries in Africa focuses on three main areas which are considered to be essential in the African context - food self-sufficiency, stability in food consumption, and access to food.

Food Self-Sufficiency

Available evidence and experience leave little doubt that the food security problem in Africa is first and foremost one of inadequate levels of locally produced food stuff (Lofchie, 1989). This is not to equate the concept of food security with that of food self-sufficiency. There is, however, no doubt that overall economic growth in Africa, hence regional food security, depends critically on enhanced productivity and expanded production of food crops. The continent clearly has a comparative advantage in food crops production, and the attainment of an acceptable growth rate in per capita food production will not only coincide with the attainment of national food security but also greater self-sufficiency in food supply at the regional level.

The fact is that, whenever African countries have been unable to meet their food requirements from local resources, they have usually been forced to look elsewhere to make up the shortfall. Food self-sufficiency is a measure of the extent to which the demand for food in a country is met from domestic production. Developments in production and trade combine to determine the degree of food self-sufficiency in each country.

If the country has the capacity to vary its food import volume, it could use imports to compensate for the variability in domestic production. However, the ability to use food imports for stabilizing consumption could be severely limited by sudden increases in world prices for food imports and/or decreases in export revenues. In such circumstances foreign exchange availability is usually the most critical factor in determining whether or not the country can import enough to meet its food requirements.

Stability in Food Consumption

The stability in food consumption patterns is an important component of food security in African countries (Christensen, 1987). Food consumption, in this regard, can be considered as comprising national production plus net imports, taking into account any changes in the level of food stocks. The problem, however, is that, in practice, it is extremely difficult to obtain all the necessary data for a sufficiently recent and accurate consumption pattern to be established. Furthermore, data on carry-over stocks is difficult to come by in most African countries. Valdès and

Konandreas' (1981) study of consumption instability in 24 developing countries over the period 1961 - 1976 has, however, shown that there is a high positive coefficient of correlation between total staple food production and consumption. This is to be expected if, in general, imports are insufficient to cover production shortfalls. This is particularly true for many countries in Africa, where fluctuations in staple food consumption closely follow fluctuations of domestic staple food production. It has also been shown that production deviations have considerable merit in explaining food consumption instability (Diakosavvas, 1989).

The coefficient of variation of food production around the long-term trend production is therefore used in this paper as a proxy for consumption variability.

The Coefficient of Variation (CV) in food production is defined as the standard deviation of the percentage fluctuations from trend and is represented as follows:

$$CV = \frac{Q_t - Q_t}{Q_t} \cdot 100$$

where:

Q_t = Actual Production

Q_t = Trend Level Production

Access to Food

Access to food is a difficult concept to measure as it involves the computation of a number of difficult to ascertain items such as access to land, credit, income and other resources. Because data on such variables are seldom available, a proxy variable, income per capita, has been used. Following the example of the UNDP in its effort to find a suitable proxy for command over resources needed for a decent living (UNDP, 1990) the logarithm of purchasing power adjusted real GDP per capita is used here to represent access to food supply. The rationale for its use is that it provides a good approximation of the relative power to buy food and to gain command over resources needed for a decent living standard. The purchasing power adjusted real GDP has been transformed into logarithm form to reflect the diminishing returns to transform income into access to food (UNDP, 1990). In other words to reflect the fact that people do not need excessive income to ensure adequate access to food.

Calculation of the Food Insecurity Index

The calculation of the Food Insecurity Index (FII) is based on how far the chosen indicators fall short of desirable levels. For food self-sufficiency,

the target is 100 percent, a level which indicates that a country is able to meet all its food requirement from local sources. Stability of food production is measured by the Coefficient of Variation (CV) of per capita food production between 1981 and 1989. The target CV used is 1.0%, a figure less than the minimum level of variation (1.6%) attained by any African country during the period. The income target is the logarithm of the average poverty line income defined as the income level below which a minimum nutritionally adequate diet plus essential non-food requirements are not affordable and expressed in purchasing - power - adjusted international dollars. The target level chosen is Purchasing Power Adjusted US\$ 1 000 per capita.

Following the UNDP example, the Food Insecurity Index is constructed in three steps. The first step defines the shortfall in each of the three basic variables in each country - food self-sufficiency (X_1), per capita food production variability (X_2), and the log of real GDP per capita (X_3). A maximum and a minimum value are determined for each of the three variables given the actual values and a shortfall measure (l_{ij}) is then obtained (ranging from zero to one) by finding the difference between the maximum and minimum values of the variable as follows for the j^{th} country with respect to the i^{th} variable:

$$l_{ij} = \frac{(\text{Max}X_{ij} - X_{ij})}{(\text{Max}X_{ij} - \text{Min}X_{ij})}$$

The next step is to find the average shortfall for all the three variables:

$$l_j = \sum_{i=1}^3 l_{ij}$$

In the final steps, the food insecurity index (FII) is calculated as:

$$\text{FII}_j = 1 - l_j$$

This procedure thus specifies a minimum value (the maximum shortfall is set equal to one) and a desirable value (no shortfall is set equal to zero) for each of the three indicators. These two values represent the end - points of a scale indexed from one to zero for each component of the food insecurity measure. Averaging the position of each country in the three scales so derived and subtracting it from unity gives the composite FII index for the country.

The values of the three indicators for each of the countries for which data was available and the resultant FII are presented in Table 1.

Table 2 provides a ranking of African countries according to their Food Insecurity Index. On the basis of this ranking, the food insecurity situation has been grouped into the following categories:

- Mildly Food Insecure
- Moderately Food Insecure
- Highly Food Insecure.

It should be reemphasized that although the main limitation of the FII constructed is that it does not include all the factors that are known to affect the food security situation in each country, the overlapping nature of many of these factors and the diversity in others makes a broader use of indicators quite complicating. There are therefore, difficult tradeoffs between broader coverage and the need for simplicity in painting the basic picture that policy makers need to examine in making the necessary decisions to tackle their food security problems. More work is, however, needed here in the future, to identify the most appropriate number of indicators to take into consideration in the construction of the FII.

The purpose of the present exercise is to provide an indication of the overall food security situation in each African country as well as an appreciation of the magnitude of the effort that would need to be made in order to attain adequate levels of food security in the future.

III. PROSPECTS FOR THE FUTURE

It has been suggested above that the food security problem in Africa is first and foremost one of inadequate levels of locally produced food stuff. Food security in Africa should, therefore, be defined within the context of national and regional food self-reliance because its attainment should depend on general increases in food production and not on imports or food aid. The definition of food security in African countries must, therefore, be seen as adequate access by most nationals of each country to mostly domestically produced food at all times. At the continental level, food security would reflect adequate access by all Africans to food mostly produced in the continent.

The fact, however, is that if past trends in food production continue, most African countries would find it increasingly difficult to feed their growing populations and would continue to import huge amounts of food. The wide gaps between current levels of basic food production and imports and levels anticipated by the year 2000 suggest that the future prospects for most countries in the region could be quite bleak if present trends continue.

However, any projection of past trends into the future is based on the assumption that political and economic choices regarding developments and improvements will not change in the future. This is certainly most unlikely. Political and economic changes which will affect performance in each individual country are likely to take place and the magnitude of the changes and their likely effect of performance will vary from country to country depending on past performance and present circumstances. However, there exists physical limits which will affect each country's ability to achieve maximum rates of growth even if all the social, economic and institutional factors which limit the attainment of this maximum are removed. For this analysis, we rely on FAO's study of the potential population carrying capacities of developing countries (FAO, 1983 b).

The FAO study attempted to estimate the physical potential of given land areas to produce food and to support projected population. The methodology used consisted of overlaying a climatic inventory on a soil map so as to identify areas with quantified soil and climatic conditions important to crop production.

Three input levels were considered - low, intermediate, and high. The low level input corresponded to traditional unimproved farming while the high input level reflected conditions and requirements associated with modern large scale farming. The intermediate level was in between these two levels.

In calculating the physical potential of land in each country, the following assumptions were made:

- all potentially cultivable land is allocated to the production of food crops to be consumed within the country. No non-food crop production is included (such as cotton, fibre, rubber, tea, coffee) and no production of crops for export or feed for livestock is assumed;
- livestock production is from grazing of lands which permit grassland but would not permit rainfed or irrigated crop production;
- contribution to the national diet from fishery production is not included;
- forestry (timber and fuelwood) is restricted to lands which would not permit grazing or crop production;
- countries have the ability to acquire and apply the different levels of input and associated infrastructure and the means of production, including labour, which are assumed to be freely available within countries and food production is distributed evenly among the population;
- in moving from low to high levels of inputs, solutions are found for social questions.

The carrying capacities of land in each country and within the collective boundaries of each of the FI groups are presented in Table 3. The physical potentials of these lands to support population have also been compared with projected population densities for the year 2000 and the theoretical deficits or surpluses determined.

A note of caution is necessary here. Several questions can be raised about the assumptions listed above. Care should therefore be exercised in interpreting the results presented in the table. It should be understood that the figures are meant to serve simply as indicative of the general situation and as guide to the relative natural resource endowments of the countries under consideration and the relative scale of the problems agricultural administrators in each country are likely to face in providing for the food security of their future populations.

Of the 40 countries under consideration in this study, 28 will have limiting population carrying capacities by the year 2000 if the low level of input use is assumed. In other words, the physical potential of the natural land resources in the countries to support population in terms of persons per hectare, would be less than the projected population density for the year 2000 under the assumptions made in the FAO study. These

countries' food needs would not be met by the year 2000 if the low level of input is assumed.

Under the high input level only two countries Rwanda and Mauritius will face limitations. It should however be pointed out that the high input level assumes the adoption of modern methods of farming with complete mechanization, a low intensity of labour use per hectare, and an essentially market-oriented agriculture with the associated economic and social infrastructure, including consolidation of holdings. Cultivation with hand tools is not taken into account under this high input situation. Consequently, in some cases this input level may result in smaller potentially suitable areas than the other input levels. For example, if the slope of available land rules out mechanized cultivation but would still permit cultivation with hand tools, the cultivable land under this scenario would actually decrease (FAO, 1983b).

The appropriateness of this high input assumptions for many of the African countries is at best debatable. While the complete mechanization assumed under this high input level could be quite effective in relaxing labour constraints in the countries in the region, the implication of the assumption for the agricultural and rural development of the countries could be profound. In many of these countries land holdings are small, capital is scarce, and labour is abundant (except during critical periods). Complete mechanization of their agriculture would, therefore, not only be perhaps unsuitable

for the technical environment, but more importantly, it could have the effect of creating more rural unemployment without necessarily lowering unit production cost.

The use of the high input assumption does, nonetheless, provide useful information to those countries who see instant mechanization as the solution for their agricultural production problems.

Hand cultivators form virtually all of the rural population in Africa and a majority of the total population and they presently produce the bulk of the food in the continent. It seems reasonable therefore, to conclude that successful mechanization of the agriculture in the continent cannot be instant but must be the result of a gradual process. The intermediate input level assumptions, therefore, appear to be more realistic and should constitute the basis for determining whether food needs can be met from the natural land resources of the countries under consideration in this study.

Of the 42 countries under consideration, 9 would be unable to meet their food needs from their land resources under the intermediate input level assumptions. The countries include: Algeria, Tunisia, Morocco, Libya, Mauritania, Somalia, Lesotho, Namibia, Rwanda, Kenya, Burundi, Niger and Mauritius. The intermediate input level is between the high level discussed above and the low input level which corresponds to traditional unimproved farming.

IV. CONCLUSION

In the past, the concept of food security was left undefined and unmeasured, perhaps by default, since the notion of food security, though not new, was considered complex. More recently, however, the concept of food security is generally accepted as entailing not only food availability through domestic production, storage and or trade, but also, and perhaps more importantly, food access through home production, purchase in the market, or food transfers.

In this report an attempt has been made to review the food security situation in African countries and to arrive at a typology of these countries in terms of their ability to meet the basic food needs of their population. Countries have been ranked on the basis of their food insecurity index. This index not only provides an indication of the overall food security situation in each country, it also provides an appreciation of the effort already made by African governments and a basis for assessing the magnitude of the task that lie a head.

This report should, be seen as a first effort to examine the food security situation in African countries. The indicators used in the food insecurity index would need to be carefully examined and refined. For example, the index is biased against high income oil and mineral exporters even though the emphasis is on food self-sufficiency.

There is need for a more comprehensive investigation of the nature of the food security problem in each African country as a basis of preparing a comprehensive national food security programme for each country. This should then be followed by the development of a comprehensive strategy by each country designed to attain a reasonable and sustainable level of food security.

The report concludes that the food security problem in Africa should be seen within the context of national and regional food self-reliance not only because the continent clearly has a comparative advantage in food production but also because the attainment of an acceptable growth rate in per caput food production will coincide with the attainment of both increased food security and greater self-sufficiency in food supply. National and continental food security must, therefore, be built on sustainable access to food by all Africans, which access must not depend more than marginally on food produced outside the continent either as direct imports obtained along commercial lines or as food aid. If such a dependence were forced on the continent it will impact negatively on scarce foreign exchange and capital resources, since to pay for such imports, African countries would have to forego other more critically needed imports as well as cut back on investments, including those needed to eradicate chronic food supply deficits or to expand export.

Table 1. Food Insecurity Index for African Countries

	Food Self Sufficiency (1986/1988)	CV of per Capita Food Production (1980/1989)	Real GDP Per Capita (PPA)		Food Security index
			Actual 1987	Log 1987	
Algeria	0.43	7.15	2633	3.42	0.55
Angola	0.73	6.44	1000	3	0.73
Benin	0.95	10.22	665	2.82	0.69
Botswana	0.82	16.08	2496	3.4	0.59
Burkina Faso	1	9.67	500	2.7	0.67
Burundi	0.98	4.94	450	2.65	0.73
Cameroon	0.88	1.68	1381	3.14	0.92
C.Africa Rep.	0.92	5.37	591	2.77	0.75
Chad	1.05	4.89	400	2.6	0.72
Congo	0.75	1.79	756	2.88	0.78
Cote d'Ivoire	0.85	4.29	1123	3.05	0.85
Egypt	0.76	3.61	1357	3.13	0.81
Ethiopia	0.94	6.24	454	2.66	0.69
Gabon	0.53	8.59	2068	3.32	0.57
Ghana	0.93	13.46	481	2.68	0.54
Guinea	0.91	5.42	500	2.7	0.71
Kenya	0.93	6.81	794	2.90	0.79
Lesotho	0.6	9.28	1585	3.20	0.59
Liberia	0.77	3.09	696	2.84	0.74
Libya	0.42	5.49	7250	3.86	0.57
Madagascar	0.92	3.33	634	2.8	0.83
Malawi	1.01	7.04	476	2.68	0.71
Mali	1.02	5.66	543	2.73	0.77
Mauritania	0.7	5.55	840	2.92	0.69
Mauritius	1.1	8.5	2.617	3.24	0.85
Morocco	0.86	13.22	1761	3.25	0.67
Mozambique	0.84	7.28	500	2.7	0.63
Namibia	0.95	6.46	1500	3.18	0.86
Niger	0.95	10.8	452	2.66	0.6
Nigeria	0.95	4.45	668	2.82	0.81
Rwanda	0.91	12.23	571	2.76	0.6
Senegal	0.87	14.17	1068	3.03	0.66
Sierra Leone	0.82	7.57	480	2.68	0.6
Somalia	0.93	3.59	1000	3	0.91
Sudan	0.99	9.9	750	2.88	0.75
Tanzania	0.97	3.8	405	2.61	0.73
Togo	0.81	5.22	670	2.83	0.72
Tunisia	0.74	11.8	2741	3.44	0.63
Uganda	0.95	9.26	511	2.71	0.66
Zaire	0.94	2.78	220	2.34	0.6
Zambia	0.93	5.78	717	2.86	0.79
Zimbabwe	1.12	17.3	1184	3.07	0.67

Table 2: Ranking of countries by Food Insecurity

Country	FI
Ghana	0.54
Algeria	0.55
Gabon	0.57
Libya	0.57
Botswana	0.59
Lesotho	0.59
Niger	0.60
Rwanda	0.60
Sierra Leone	0.60
Zaire	0.60
Mozambique	0.63
Tunisia	0.63
Senegal	0.66
Uganda	0.66
Burkina Faso	0.66
Morocco	0.67
Zimbabwe	0.67
Benin	0.69
Ethiopia	0.69
Mauritania	0.69
Malawi	0.71
Guinea	0.71
Chad	0.72
Togo	0.72
Angola	0.73
Burundi	0.73
Tanzania	0.73
Liberia	0.74
Central African Republic	0.75
Sudan	0.75
Mali	0.77
Congo	0.78
Kenya	0.79
Zambia	0.79
Egypt	0.81
Nigeria	0.81
Madagascar	0.85
Mauritius	0.85
Cote d'Ivoire	0.85
Namibia	0.86
Somalia	0.91
Cameroon	0.92

Table 3 - Africa: Current and Projected Maximum Population Carrying capacities by the year 2000

Performance Groups/Countries	Population			Physical Potential of Land, Year 2000 (Persons per hectare)					
	Density	Growth rate	Density	Capacities			Deficits or surplus		
	1975	1980-2000	2000	Low	Medium	High	Low	Medium	High
HIGHLY FOOD INSECURE									
Ghana	0.43	3.3	0.97	0.97	3.9	10.56	0	2.93	9.59
Algeria	0.07	3.1	0.15	0.05	0.12	0.21	-0.1	-0.03	0.06
Gabon	0.02	1.6	0.03	1.5	4.84	10.7	1.47	4.8	10.67
Libya	0.01	4	0.03	0.04	0.05	0.06	0.01	0.02	0.03
Botswana	0.01	3	0.02	0.02	0.08	0.77	0	0.06	0.75
Lesotho	0.39	2.7	0.69	0.18	0.45	1.02	-0.51	-0.24	0.33
Niger	0.04	3.2	0.08	0.01	0.02	0.34	-0.07	-0.06	0.26
Rwanda	1.65	3.4	3.74	0.28	1.32	2.96	-3.46	-2.42	-0.78
Sierra Le	0.43	2.8	0.85	0.75	3.81	6.86	-0.1	2.96	6.01
Zaire	0.11	2.9	0.22	1.23	5.48	12.23	1.01	5.26	12.01
Mozambique	0.12	2.9	0.24	0	2.01	6.81	2.26	1.72	6.57
MÖDERATELY FOOD INSECURE									
Tunisia	0.34	2.3	0.59	0.41	0.62	0.95	-0.18	0.03	0.36
Senegal	0.26	2.8	0.51	0.39	1.14	5.4	-0.12	0.63	4.89
Uganda	0.57	3.3	1.27	0.56	2.14	7.46	-0.71	0.87	6.19
Burkina F	0.22	2.8	0.43	0.22	0.98	4.99	-0.21	0.55	4.56
Morocco	0.39	2.5	0.81	0.64	0.94	1.34	-0.17	0.13	0.53
Zimbabwe	0.16	3.5	0.36	0.34	1.32	4.78	-0.02	0.94	4.4
Benin	0.28	3.3	0.61	0.55	2.48	8.92	-0.06	1.87	2.35
Ethiopia	0.26	2.8	0.5	0.17	0.59	2.55	-0.33	0.09	2.05
Mauritania	0.01	2.8	0.03	0.01	0.03	0.09	-0.02	-0.01	0.06
Malawi	0.56	3.4	1.28	0.82	0.03	6.1	-0.46	1.4	4.82
Guinea	0.18	2.9	0.36	0.61	2.18	7.07	0.25	1.82	6.71
Chad	0.03	2.3	0.06	0.11	0.55	2.4	0.05	0.49	2.34
Togo	0.42	3.1	0.89	0.73	3.25	9.08	-0.16	2.36	8.19
Angola	0.05	2.8	0.1	0.43	2.23	7.5	0.33	2.13	7.4
Burundi	1.48	2.7	2.81	0.31	1.64	3.21	-2.5	-1.17	0.9
Tanzania	0.17	3.3	0.38	0.43	1.64	5.6	0.05	1.26	5.22
Liberia	0.17	3.6	0.42	0.86	4.23	11.22	0.44	3.81	10.8
Central A	0.03	2.7	0.06	0.72	3.35	9.58	0.66	3.29	9.52
Sudan	0.07	2.7	0.14	0.32	1.04	4.21	0.18	0.9	4.07
Mali	0.05	3	0.1	0.08	0.3	1.38	-0.02	0.2	1.28
Congo	0.04	2.9	0.08	1.19	4.75	11.84	1.11	4.67	11.26
Kenya	0.24	4.2	0.65	0.1	0.24	0.91	-0.55	-0.41	0.26
Egypt	0.37	2.5	0.65	1.14	1.14	1.14	0.49	0.49	0.49
Zambia	0.07	3.4	0.15	0.66	2.9	10.3	0.51	0.03	10.15
MILDY FOOD INSECURE									
Nigeria	0.72	3.4	1.65	0.6	2.27	7.68	-1.05	0.62	6.08
Madagascar	0.13	2.8	0.26	0.95	0.08	9.63	0.69	3.12	9.37
Mauritius	4.78	1.3	6.75	3.33	6.08	5.63	-3.42	-0.67	-1.12
Cote d'Iv	0.21	3.1	0.46	1.51	5.15	11.67	1.05	4.69	11.21
Namibia	0.01	2.3	0.02	0.01	0.03	0.39	-0.01	0.01	0.37
Somalia	0.05	2.2	0.11	0.03	0.05	0.12	0.08	-0.06	0.01
Cameroon	0.16	2.5	0.3	1.62	4.41	12.9	1.32	4.11	12.6

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