Food Security and Poverty Alleviation Initiative in the OIC Member States of Sub-Saharan Africa: A Preamble to Cassava Integrated Project

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Table of Contents

1 Introduction

Sub-Saharan Africa is the only region in the world where food security and poverty situation have been worsening through time. The number of people living below the poverty line in the region has increased by 50% over the last fifteen years (Amoaka 2003). It is estimated that 340 million people live on less than a dollar a day and that one third of the population, mostly women and children, are undernourished (Conway & Toenniesson 2003). The total number of undernourished people increased by one million during the period 2000-2002. Based on the current trends of poverty in Sub-Saharan Africa, the World Bank estimates that the region will be able to meet the Millennium Development Goals (MDGs) of poverty and hunger by 2147 as opposed to the target year 2015(Practical Action 2005).

Agriculture has been recognised, in many reports on poverty in Africa, as the key sector for achieving the poverty targets of the MDGs. Most of the African economies, particularly those in Sub-Saharan Africa, are primarily based on agriculture. Yet, the food production in the region has failed to keep pace with the population growth rates over the past three decades. The Millennium Report (2005) has, for example, shown that the region of Sub-Saharan Africa has been lagging behind in cereal yield per hectare. According to the estimates of the International Fund for Agricultural Development (IFAD), 80% of the food insecure population in Africa lives in the rural areas and more than 90% of them are involved in agricultural activities in marginal lands.

The agricultural systems of the rural farmers in Sub-Saharan Africa are based, to a large extent, on subsistence farming and are sustainable under the conditions of low population pressures. But higher population growth rates led to the expansion of small-scale farmers with marginal lands in rural areas. Together with the lack of land management practices, this has contributed to the increasing loss of soil nutrients and land degradation. In many countries of the region forests are disappearing and soil nutrients stocks are being

depleted. According to the International Centre for Soil Fertility (IFDC), some 170 million hectares of farmland is degraded annually. An estimated 50,000 hectares of Africa's forests and 60,000 hectares of savannah are lost annually, resulting in severe environmental degradation and decline in agricultural production per capita.

Therefore, addressing the problems of the rural population and agricultural productivity in Sub-Saharan Africa should be the primary concern of any initiative for poverty alleviating programme in the region since improvements in agricultural productivity lead directly to increases in food production and improved nutrition for the poor.

However, a recent report by Practical Action (2005) suggests that most of the development assistance to the region has shifted towards export-led growth and the state support for agriculture has been progressively withdrawn. This has caused a substantial decline in the productivity of the small-scale farmers. It has also been reported that while the total aid disbursements to Africa have increased from $15 billion in the 1990s to $20 billion in this decade, the assistance to agricultural sector has stagnated. According to the findings of the survey of the Practical Action on the small-scale farmers in Africa, the farmers have the following five demands from the donors and their governments:

(1) Access to agricultural inputs such as land, credit, water, seeds and breeds.
(2) Access to appropriate agricultural extension and technology.
(3) Agricultural support programs that meet the needs of the marginal farmers.
(4) Long-term programs to ensure food security rather than direct provision of food aid.
(5) Participation of farmers in the decision making process of agricultural development.

In 2002, at the World Summit for Sustainable Development, the donor countries have supported the proposed strategic framework for developing an integrated socio-economic development in Africa under the New Partnership of Africa's Development (NEPAD). The NEPAD strategic framework document is a mandate given by the Organisation of African Unity (OAU) to the five initiating Heads of States (Algeria, Egypt, Nigeria, Senegal and South Africa). It is a pledge by African leaders, based on a common vision and a firm and shared conviction, that they have a pressing duty to eradicate poverty and

to place their countries, both individually and collectively, on a path of sustainable growth and development.

In the priority area of agriculture, the NEPAD's strategic framework document seeks to maximise the contribution of this important sector for most of the African countries through increasing agricultural productivity and value added in order to eliminate hunger, reduce poverty and food insecurity as well as to enhance agricultural manufacturing and exports. To this end, NEPAD prepared, through the facilitation of and close collaboration with the FAO, the Comprehensive Africa Agriculture Development Programme (CAADP).

The CAADP, which is a framework for the restoration of agriculture growth, food security and rural development in Africa, has been endorsed by the African Ministers of Agriculture at a special meeting in Rome in 2002 and later adopted by the African Heads of State and Government in Maputo in 2003. The major goal of the CAADP is improving the productivity of agriculture to attain an average annual growth rate of 6 percent, with particular attention to small-scale farmers. The CAADP draws the attention of African governments to a wide range of actions to revitalise Africa's agriculture. In so doing, it focuses on the following five mutually reinforcing pillars (Africa Renewal, July 2006):

(1) Expanding the acreage of irrigated African farmland and improving land management and farming techniques to preserve and improve soil quality.
(2) Investing in rural infrastructure, including roads and railways, storage and processing facilities, markets, communications systems and reliable supply networks for farmers.
(3) Making food production a high priority, both to combat hunger and for export, and improving emergency responses to natural disasters and conflicts.
(4) Strengthening African agricultural research and development, including in advanced technologies and farming methods, and disseminating advances quickly and efficiently to farmers, suppliers and buyers.
(5) Ensuring sustainable development of livestock, fisheries and forestry resources.

Within the framework of the CAADP, NEPAD has launched several initiatives to improve food security and to increase income generation potential of the small-scale farmers in Africa. One of these initiatives is "*The Pan Africa Cassava Initiative*" in partnership with the International Institute of Tropical Agriculture (IITA), where "Cassava" is one of the major food crops in Sub-Saharan Africa.

In two of the NEPAD conferences, which were jointly organized by the Initiative for Development and Equity on African Agriculture (IDEAA) in August 2003 and by the International Food Policy and Research Institute (IFPRI) in December 2003, it had been concluded that Cassava must be promoted as a fighter of poverty in Africa. The two conferences also called for the rapid implementation of CAADP and declared Cassava as one of the key crops within the CAADP.

The preliminary report titled "Poverty in Sub-Saharan Africa: The Situation in the OIC Member Countries" prepared by the SESRTCIC in February 2007 reached some key recommendations to reduce poverty in the OIC member countries in Sub-Saharan Africa. Among other things, the report argued that increasing the productivity and the value added of the agricultural activities of the poor people in the rural areas is of utmost importance for reducing poverty in most of these countries.

In the light of these results, the present report aims at introducing an initiative for a food security project proposal for alleviating poverty which is based on increasing the productivity of Cassava and the potential of Cassava processing in some OIC member countries in Sub-Saharan Africa and that could be used as a model in other member countries in the region. Section 2 highlights the importance of Cassava in achieving food security and its potential in generating income for the marginal farmers. Section 3 discusses the farming systems in Sub-Saharan Africa and their relevance to agricultural productivity. This discussion facilitates the selection of project sites for the Cassava initiative in the initial phase. Section 4 provides the broad outline and the key components of the proposed pilot project.

2 Cassava: A Poverty Fighter in Africa

2.1. The Crop of Last Resort

Cassava or manioc (*Manihot esculenta*) is a woody shrub with an average height of one metre, and has a palmate leaf formation. The stem is the planting material from which grows the roots and shoots. Cassava produces bulky storage roots with a heavy concentration of carbohydrates. The shoots grow into leaves that constitute a good vegetable rich in proteins, vitamins and minerals. Although humans most consume Cassava, it is also a source of raw material in many agro-allied industries and for animal feed.

Cassava has originated in South America and is extensively cultivated in humid and sub-humid tropical regions, particularly in Africa, for its edible starchy tuberous roots, a major source of carbohydrates. In 2005, Cassava was planted on 18 million hectares around the world, 57% of which are in Africa, 18% in Asia and 16% in Latin America. The world production of Cassava (fresh and dried) was estimated in the same year to be about 208.1 million tones, 118.5 million tones of which were grown in Africa, 53 million tones in Asia and 36.6 million tones in Latin America and the Caribbean (Table 2.1).

In Africa, Cassava is cultivated, mainly by smallholders on marginal lands, in around 40 countries through a wide belt from Madagascar in the Southeast to Senegal and to Cape Verde in the Northwest. Africa now produces more Cassava than the rest of the world combined (Table 1.2). The main African Cassava producing countries are Nigeria with 35% of all African Cassava production, Democratic Republic of Congo (19%), Ghana (8%), Tanzania (7%) and Mozambique (6%) (IITA 1997).

However, although yield of Cassava as a mono-crop, can be as high as 90 tons of fresh roots per hectare, the average yield in Africa is around 10 tons per hectare. This suggests a significant gap between the yield of Cassava harvested under optimal experimental conditions (over 80 tons/hectare) and the average yield harvested by African farmers

(around 8-12 tons/hectare) (Taylor and Fauquet 1997). It also reflects the numerous challenging factors facing the African farmers in Cassava subsistence agriculture.

Table 2.1
Cassava (Fresh and Dried),Yield per Hectare and Production in 1994/2004.

	Yield kg/ha			Production (mt)		
	1994	2004	% Change	1994	2004	% Change
Niger	11890.9	20000	68.2	65,400	100,000	52.9
Guinea-Bissau	16478.9	15200	-7.8	14,831	38,000	156.2
Uganda	6500	13513.5	107.9	2,080,000	5,500,000	164.4
Cameroon	12703.7	13448.3	5.9	1,715,000	1,950,000	13.7
Benin	8145.1	13333.3	63.7	1,145,800	4,000,000	249.1
Chad	4108.9	12037	192.9	184,900	325,000	75.8
Mali	7343.6	11523.8	56.9	1,197	24,200	1921.7
Nigeria	10592.8	9271.2	-12.5	31,005,000	38,179,000	23.1
Togo	5879.5	6041.7	2.8	531,526	725,000	36.4
Mozambique	3689.9	5857.1	58.7	3,351,565	6,150,000	83.5
Comoros	5361.1	5523.8	3	48,250	58,000	20.2
Sierra Leone	5867.5	5200	-11.4	243,500	390,000	60.2
Gabon	4581.4	5111.1	11.6	197,000	230,000	16.8
Côte d'Ivoire	5045.4	5000	-0.9	1,564,080	1,500,000	-4.1
Guinea	7194.2	5000	-30.5	524,956	1,350,000	157.2
Senegal	2508.7	5000	99.3	76,915	180,000	134
Gambia	3000	3000	0	6,000	7,500	25
Burkina Fasso	2000	2000	0	1,000	2,000	100
Sudan	2125	1733.3	-18.4	8,500	10,400	22.4
World	9806.7	10946.9	11.6	164,592,242	202,648,218	23.1
Africa	8076	8823.6	9.3	83,753,601	108,109,713	29.1

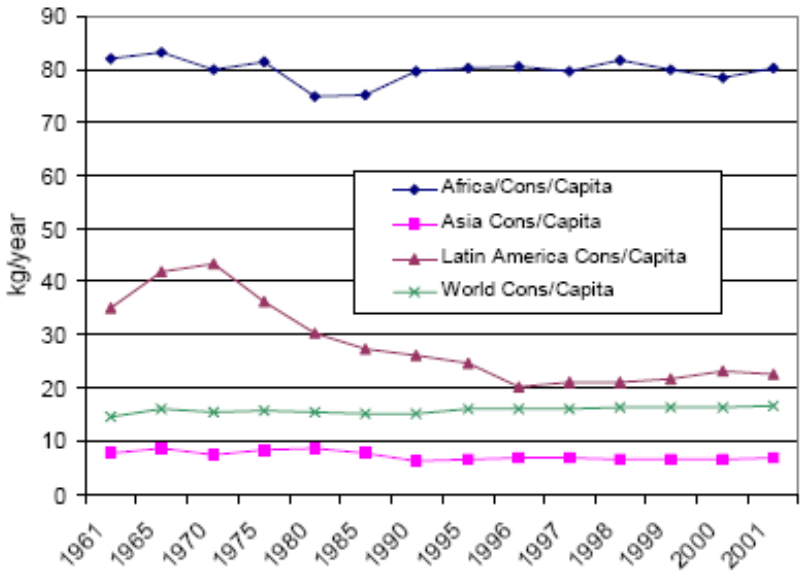
Source: Lawrence et el. (2006)

Moreover, although some major African Cassava producer countries have significantly increased their production in the past two decades, such as Nigeria (22% - 35%) and Ghana (4% - 8%), this increase in production was due, to a large extent, to the increase in the cultivated land area rather than to an increase in yield per hectare. While the Cassava cultivated land area increased by 70% in the past two decades, total yields have increased only by 33% during the same time period (IITA, 1997). According to the survey conducted by Collaborative Study of Cassava in Africa (COSCA), funded by the Rockefeller Foundation, the increase in Cassava cultivation was mainly due to the

increase in famine, hunger and drought. This confirms the value of Cassava as a food-security crop (Hillcocks, 2002).

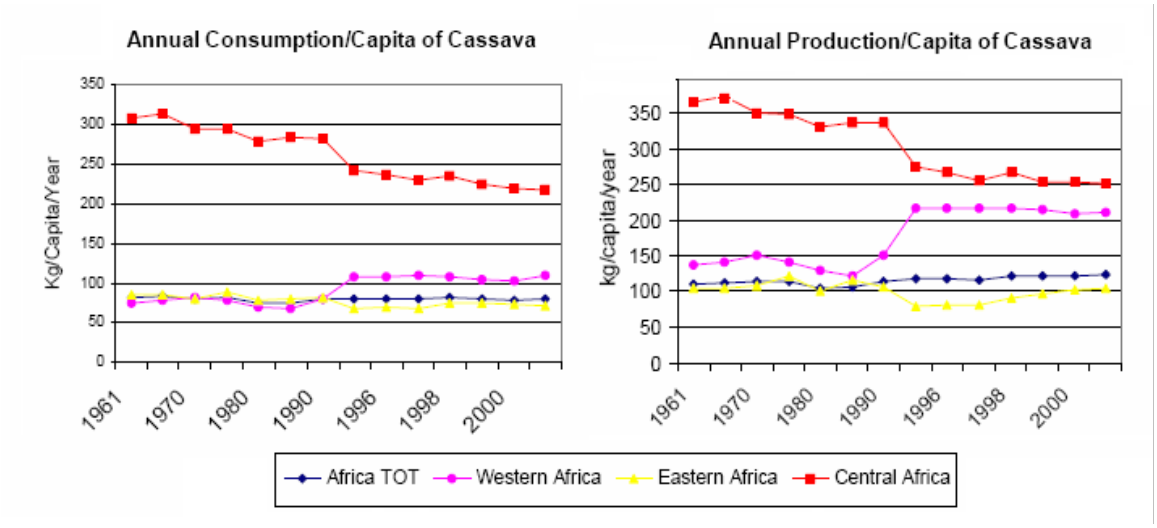
On the other hand, it is estimated that more than 500 million people around the world obtain 100 Kcal per day from Cassava. Of which, 70 million people in Africa consume more than 500 Kcal per day from Cassava (Kawano 2003). In this context, the average annual per capita consumption of Cassava in Africa was estimated in 2001 to be around 80 kg/capita as compared to the world average of only 17 kg/capita (see Figure 2.1). This also confirms Cassava as a major food-security crop in the continent. Yet, although the average production and consumption per capita of Cassava in Africa, as whole, shows marginal increase over time, it has been declining significantly in Central Africa. In contrast, Cassava production and consumption per capita in Western Africa shows a strong upward trend (see Figure 2.2).

Figure 2.1
Cassava consumption per capita, worldwide and by region.



Source: Aerni (2004)

Figure2.2
Annual Consumption and Production of Cassava per Capita in Africa.



Source: Aerni (2004).

Cassava is considered as the 'crop of last resort' because of its ability to grow on poor soils and under difficult climatic conditions. Because of its massive leaf production which drops to form organic matter thus recycling soil nutrients, Cassava requires little or no fertilization and maintains a steady production trend over a fairly long period of time in a continuous farming system. Cassava is, therefore, one of the cheapest sources of calories of all staple crops in Africa. It is grown by a large number of smallholders in several ecological zones. Furthermore, it has a unique advantage of flexible root harvesting where the roots can be safely left under the ground for 7 months to 2 years (Hillocks et al. 2001).

Indeed, there are several reasons for the popularity and rapid spread of Cassava in Sub-Saharan Africa, particularly in West Africa. These reasons can be summarized as follows (NEPAD Newsletter, 2004): (1) Cassava adapts to poor soils on which most other crops fail, (2) it resists drought, except at planting time, and locust damage, (3) Cassava is a relatively high yielder and an excellent source of calories and can produce more carbohydrate per unit area than is provided by other staples, and (4) Cassava is relatively inexpensive to produce: (i) it requires very little weeding when planted in optimal plant

populations; (ii) it has no critical planting date, provided there is enough moisture at planting; and (iii) its roots can be left stored in the ground and harvested when required.

That is why Cassava is sometimes referred as the crop of the last resort in Africa. Talking about Cassava as a main food staple in Sub-Saharan Africa and its adaptability to the tropical African environment, Alfred Dixon, a Cassava Breeder at the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, says "Cassava is to the African peasant farmers what rice is to the Asian farmers, or what wheat and potato are to the European farmers".

2.2. Cassava as a Food Staple in Africa

The Cassava plant gives the highest yield of food energy per cultivated area per day among other crop plants, except possibly for sugarcane. According to DeVries and Toenniessen (2001), its potential yield may reach 75 tons/ha and up to 250,000 calories/ha/day. Cassava roots are very rich in starch with a heavy concentration of carbohydrates, about 80%. They also contain significant amounts of calcium (50 mg/100g), phosphorus (40 mg/100g) and vitamin C (25 mg/100g). On the other hand, Cassava leaves are a good source of proteins, vitamins and minerals. New knowledge of the biochemistry of the crop has proved that the proteins embedded in the leaves of Cassava are equal in quality to the protein in eggs[1].

Cassava varieties are often categorized as either 'sweet' or 'bitter'. The sweet Cassava varieties are eaten raw or cooked through boiling in water or oil. The bitter varieties are processed for the production of flour or starch (Grace 1977). Boiled Cassava roots need to be pounded alone or in combination with other starchy staples. However, preparation of pounded Cassava is cumbersome.

Cooked in various ways, Cassava is used in a large variety of dishes. There are five common groups of Cassava food products marketed by the farmers and food processors in Africa: fresh roots, dried roots, pasty products, a granulated product and Cassava leaves (Felix Nweke 2003).

[1] Babaleye, Taye, "Cassava, Africa's Food Security Crop", IITA.

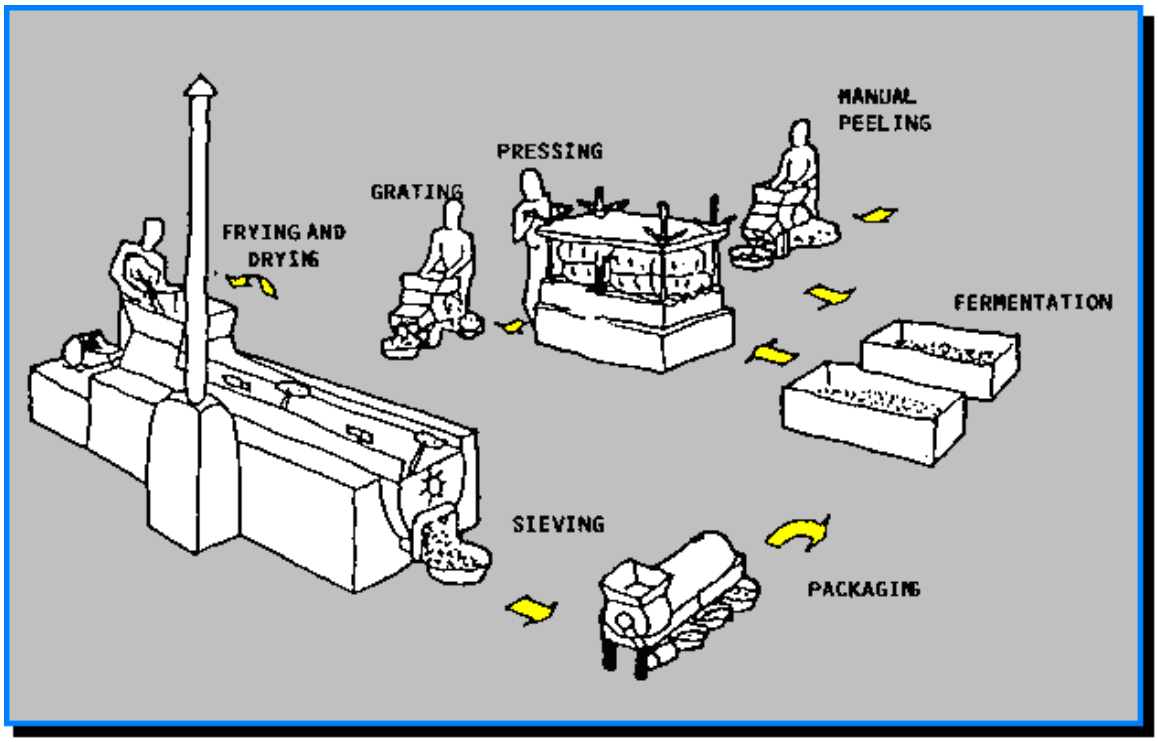
Dried cassava roots are also stored or marketed as chips and flour. In Nigeria and Ghana, fermentation by soaking in water for two to five days is the most common method of preparing dried cassava roots. Only recently mechanized graters are also being employed in preparing dried Cassava root flour which saves time and labor (Alyanak 1997). Dried cassava roots are used as a famine-reserve crop.

Preparation of pasty products involves soaking of roots in water for three to five days. The soaked roots are then manually crushed and later sieved. The advantage of pasty product of cassava is that they increase the shelf life and reduces its volume in comparison with fresh roots. It is commonly used to feed labour employed in cassava production. In some countries the pasty products are also marketed in the urban areas.

One of the most popular Cassava food-products with several advantages is '*gari'*. It is stored and marketed in a form that it is ready to eat. It has a long shelf life. It is produced in countries where cassava is produced as a cash crop, such as Nigeria and Ghana. The preparation 'gari' requires peeling, grating, fermentation and toasting of the roots. After toasting it takes the form of flour and is used in various types of meals. It has large demand in the urban areas (Doku 1969 and Ngoddy 1977). The traditional gari processing at village level is depicted in Fig 2.3. Cassava processing normally involves several stages: peeling, grating, soaking, fermenting, pressing, roasting and milling. The bulk of cassava products are normally processed by women at village level. Sometime women form informal groups in post harvest related activities. Some of the processing stages are also shown in Appendix 1.

Cassava leaves are also edible and they are highly nutritious. They are an extremely valuable source of vitamins A (carotene) and C, iron, calcium, and protein (Latham 1979). Cassava leaves are an important vegetable in the Congo, Madagascar, Sierra Leone, Tanzania and Zambia. However, they are only available during rainy seasons. In West Africa, if consumption of Cassava leaves can be promoted as a vegetable, it can make Cassava production more profitable (Dahniya 1983 and Lutaladio and Ezumah undated).

Figure 2.3
Traditional stages of "Gari" processing.



Source: Adapted from FAO (2005).

All in all, Cassava roots and leaves, if properly processed, can therefore provide a balanced diet protecting millions of African children against malnutrition. If properly processed and marketed, Cassava can also be a cash crop and a significant source of income generation for millions of people in rural areas in many African countries.

2.3. Cassava as a Cash Crop in Africa

Cassava has played various important roles in African development according to the stage of the Cassava transformation in a particular country (Felix Nweke 2003). For example, these include the role of cassava as a famine reserve crop, rural food staple, cash crop and urban food staple, industrial raw material and livestock feed. Currently, the first three roles are dominant in all cassava producing countries in Africa. Yet, high cost, poor infrastructure, lack of access to markets and the low quality output due to inefficient processing methods are the main factors which are still limiting the ability of the African Cassava to compete for industrial and livestock feed industries (Felix Nweke 2003).

The Global Cassava Development Strategy endorsed at the International Validation Forum, organized by Food and Agriculture Organization (FAO) and International Fund

for Agriculture Development (IFAD) in April 2000, is based on the belief that growing demand for Cassava can lead to rural industrial development and contribute to the economic development in Cassava producing countries around the world.

The transformation of Cassava into a high yielding cash crop, such as pastry products and dry cereal (gari) requires shifting from the low yielding and low production levels of Cassava as a famine reserve crop to the highly improved varieties which have been developed and introduced by the IITA. In this context, it is worth mentioning that two of the largest producers of Cassava in Africa, namely Nigeria and Ghana, have succeeded in achieving a significant Cassava transformation over last two decades. This was due, among others, to the following two major factors (Felix Nweke 2003):

(1) The introduction of new high yielding TMS (Tropical Manioc Selection) varieties by the International Institute of Tropical Agriculture (IITA) in these two countries. This has contributed up to 40% increase in the Cassava yield without any application of fertilizers. In addition, biological control of the Cassava mealy-bug has been applied effectively in these countries.

(2) Mechanical graters to prepare ‘gari’ have been introduced, replacing the traditional tedious methods and labour intensive of grating the cassava roots by hand. The employment of grating machines not only increased the efficiency of post-harvest processing, but also released labour from traditional processing to plant more Cassava.

Another important factor was the coherent agricultural policies of the governments. In 2002, the Presidential Initiative on Cassava production and export had been initiated in Nigeria. The objective of the initiative is to promote Cassava as a foreign exchange earner in the country. The target was set to earn 5 billion US dollar from the value added of Cassava exports by the year 2007. In contrast, Ghana has lagged behind Nigeria by a decade in this transformation.

The IFAD report on Nigeria (IFAD 2004), suggests that the scope for increasing the use of Cassava in Nigeria’s industries would require the development of an efficient and well-integrated production and marketing system. It has recommended both the public and private sectors to enhance their investments for developing Cassava products for industrial uses in Nigeria and has foreseen good returns and prospects for the future of Cassava in Nigeria and in the region as a whole.

In one of the reports, importance of high yielding cassava varieties and farmers own initiative had been highlighted. The story reveals that a little support to the farmers can make a significant difference in alleviating poverty and bringing prosperity (See Box 2.1).

Box 2.1 African gari story

On the road from Benin City to Lagos, Nigeria, lies a village that provides an example of farmer lead development project based on gari, a cassava-based food. The exact how, whos and whys are not known but the outcome is clear. Cassava has been the driving force in transforming the life of this village.

Sometime during the 1970s or early 1980s cassava ceased to be produced in this area because of the yield loss owing to cassava mosaic and spider mites. Around 1986, IITA personnel asked some farmers to try out a new sweet potato propagation system. In one of their subsequent visits IITA personnel left some improved cassava stakes. Nothing more was done or recorded regarding the cassava, but follow-up visits continued regarding the use of the sweet potato system. On a visit in 1988 a large white structure was noted behind the house of one of the villagers. Questions about this structure revealed that the few cassava stakes that had been left behind had grown into a very profitable business.

The facts seem to be:

1. The improved cassava grew very well, better than any previous cassava, and without problems of mosaic and spider bites.
2. The villagers marketed crops and processed food along the roadside.
3. The volume of traffic greatly increased with the completion of the new road from Benin City to Lagos.
4. Their gari was very popular.

The latter observation led the villagers to think about producing more gari and selling it in Lagos, now that it was relatively easy to travel to Lagos. The exact sequence of events is not known but in the process of expanding the production and marketing of gari someone came up with the technique that greatly increased the batch size for cassava soaking and fermenting. The technique entailed sewing together large plastic bags and placing the filled bag between 2 presses that were connected by giant bolts (approximately 2 to 2. 5 m in length). Nuts were tightened to squeeze the press and remove the water from the fermenting cassava. The capacity of this new technology was about 750Kg. This volume of fermented gari presented problems of roasting and marketing. Roasting continues to be done the traditional way, perhaps using slightly larger skillets, but with no great change in efficiency. Marketing is now done in Lagos, with the gari being transported to Lagos and sold to wholesalers. The villagers do the transportation by the pickup truck that they purchased with the help of a group credit program.

Source: FAO (2004).

3 Farming Systems

The farmers in Africa follow a wide range of farming systems that vary according to the major agro-ecological zones. In turn, food production and issues related to food security depend on these systems unlike in other parts of the world where these are based on limited number of systems (Dunstan et el. 2003). The farmers in Africa in general cultivate multitude of crops, 10 or more, which can vary according to the soil type and topographical position. Dixon et al (2001) have provided a comprehensive mapping of these farming systems. It has been shown that these mixed cropping systems help diminish risk and crop losses from various pests and diseases. These farming systems have been evolving through time. The dynamics not only depend on the endogenous factors, such as labor, technology in use and resource base, but they may also depend on exogenous factors, access to markets, changes in demand and agricultural policies , ((Dunstan et el. 2003).

Cassava is one of the principle crops in five of the fourteen main farming systems. These include: Cereal-Root Crop Mixed, Root Crop, Highland Perennial, Forest Based and Tree Crop. In Table 3.1 (Dixon et al 2001), the five farming systems with land area, agricultural population, principal crops, conditions of poverty and potential of agricultural growth are being provided. Furthermore, the mapping of these farming systems is also shown in Map 3.1.A. The brief summary of these five farming systems is provided below (Also see Table 3.1).

Cereal-root crop mixed.

The farming system is found mainly in West Africa on the Northern and Southern Guinea savannahs, the broad band extends through most of the countries in West Africa (see map 3.1.A). It accounts for 312 million hectares (13 per cent) of the land area and total population of 85 million in the region. It mainly belongs to the dry sub-humid zone. The average rainfall varies from 800 mm in north to 1200 mm in the south.

There has been major under-utilization of resources in the region. It is endowed with abundant land which has not been utilized because of low density of population and poor infra structure. This is one of the reasons why this region is considered to be the one with the highest agricultural growth in Africa (Dixon 2001).

Root Crop.

The system stretches from Sierra Leone to Côte d'Ivoire, Ghana, Togo, Benin, Nigeria, and Cameroon. On the southern part it gets merged with the "forest based" farming system and on the northern side into the "cereal-root crop mixed" system. Risk of drought is low compared to the cereal crop mixed system. Agricultural-growth and poverty-reduction potential are moderate.

Highland perennial.

This farming system is mainly present in Ethiopia, Uganda, Rwanda, and Burundi. It also carries the highest rural population density of the region. The land holdings are generally small (average cultivated area per household is just under one hectare). Decline in soil fertility and increasing poverty and hunger are among the key constraints.

Forest based.

This farming system belongs to the humid forest zones of the Congo Democratic Republic, the Congo Republic, Southeast Cameroon, Equatorial Guinea, and Gabon. The population-density itself is low but due to poor infra structure market access is one of the major problems.

Tree crop.

This farming system stretches from Côte d'Ivoire to Ghana and from Nigeria and Cameroon to Gabon. The main source of income comes from the industrial tree crops, notably cocoa, coffee, oil palm, and rubber. Food crops, such as cassava, are grown mainly for subsistence. A variant of the tree-crop system is the "rice-tree crop" system located in Madagascar. It is located in the moist sub-humid and humid zones, in which

banana and coffee cultivation is complemented by rice, maize, cassava, and legumes. The main vulnerability stems from the fluctuations in the prices of the industrial crops.

Most of the agriculture land in the OIC member states belongs to "Cereal Root Mixed", "Root Crop" and "Tree Crop" farming systems with few exceptions, such as, Gabon (Forest Based) and Uganda (High Land Perennial).

Dunstan et al (2003) have evaluated the relevance of these farming systems in the context of prevalence of poverty and agricultural growth potential. The systems with high poverty and moderate growth potential or high growth potential and limited poverty have been given higher priority for interventions to improve food security and poverty alleviation. Five farming systems have been selected for their promise in actually reducing poverty and realizing agricultural growth. These include:

- Maize Mixed;
- Tree Crop;
- Irrigated;
- Cereal Root Crop Mixed;
- Agro-pastoral.

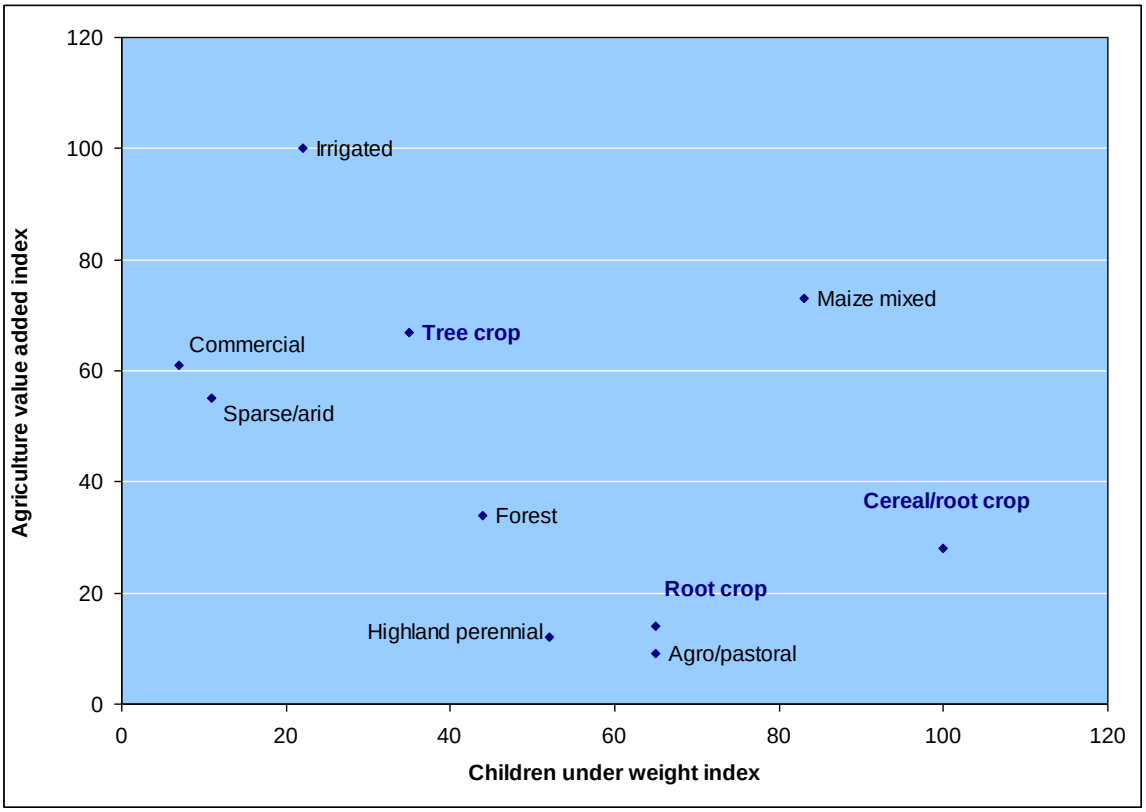
Two indicators of "agricultural value added" and "underweight children" have been used in prioritizing these five systems. The indicators have been plotted against each other (See Fig 3.1). Accordingly the systems in the right or upper part have been considered important for food security interventions. Cassava is one of the principal crops in the Cereal Root Crop Mixed and Tree Crop systems, among the five prioritized systems. Given the relatively higher poverty incidence in the areas belonging to the "Cereal Root Crop Mixed" system, (See Fig. 3.1), it would be suggested that the proposed cassava project should be implemented within this system in its initial phase. The project can be extended to the tree crop and root crop systems in the later stages.

Table 3.1
Farming Systems of Sub-Saharan Africa (SSA), Dixon et al (2001).

Farming System	Land Area (% of region)	Agriculture Population (% of region)	Prevalence of Poverty	Agriculture Growth Potential
Cereal-Root Crop Mixed	13	15	Limited	High
Root Crop	11	11	Limited - Moderate	Medium
Highland Perennial	1	8	Extensive	Low
Forest Based	11	7	Extensive	Low-Medium
Tree-Crop	3	6	Limited-moderate	Medium-High

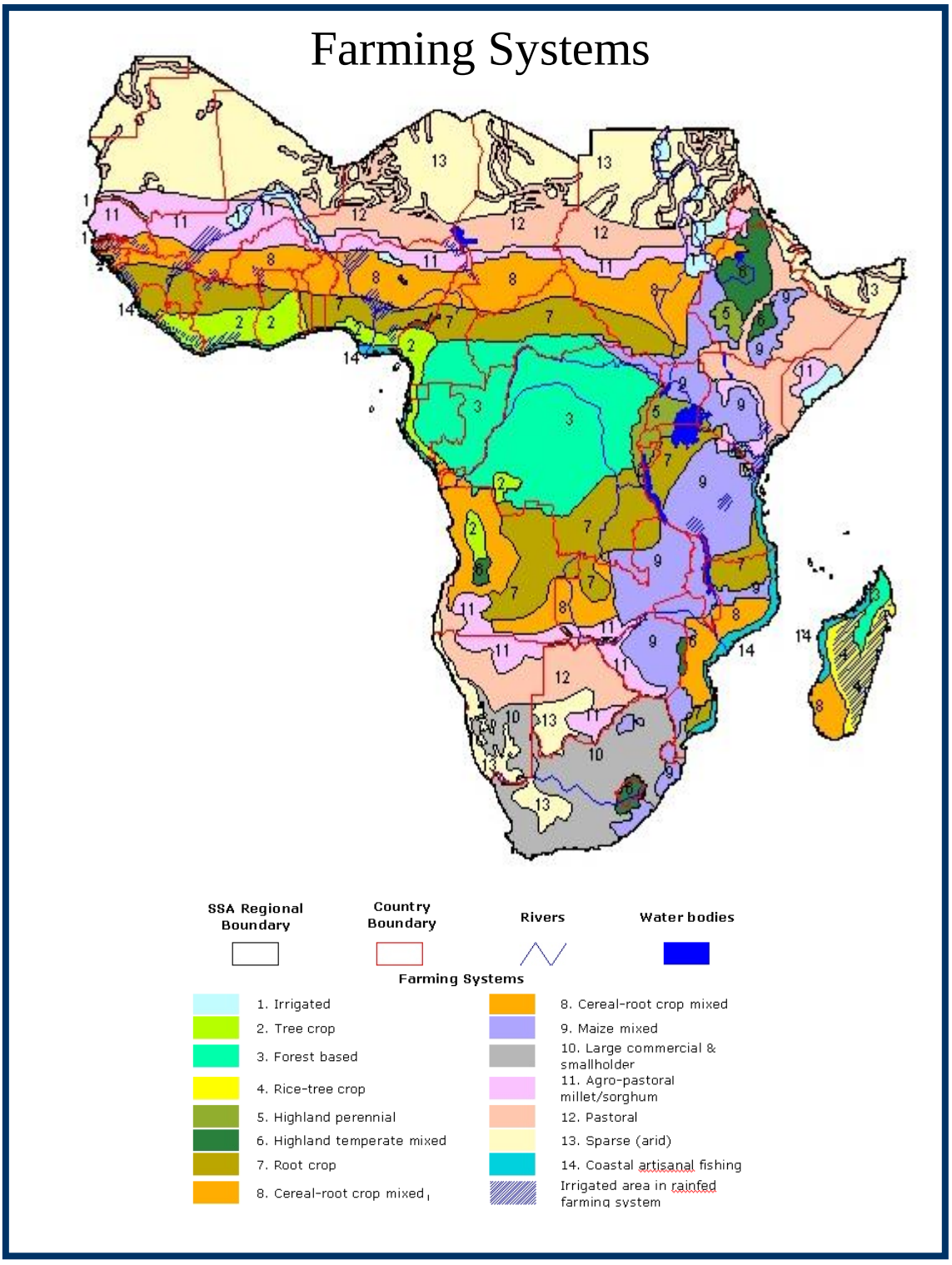
Source: Dixon et. al. (2001)
Note: Poverty is defined by the international poverty-line of average daily consumption equivalent to US$1 per day per capita. Prevalence of poverty refers to number in poverty, not depth of poverty, and is assessed relative to the region

Figure 3.1
Malnutrition and Agricultural Production Value Indices for major Farming Systems in Africa.



Source: Dixon et al. (2001).

Map 3.1 *Farming Systems in Africa.*



4 Integrated Cassava Project

The main conclusions of the above two sections can be summarised as follows:

1- Cassava is foreseen as a poverty fighter crop in Africa. Under severe drought conditions, it is the crop of last resort. It is one of the main food staples and cash crops in the Western and Central African countries in the sub-Saharan region.

2- If it is properly processed and marketed, Cassava can become a good source of balanced diet protecting millions of African children against malnutrition and a good income generator for millions of people in rural areas in many African countries.

3- Cassava has a high adaptability to the tropical African environment and farming systems. It is generally suitable for "Cereal-Root Crop Mixed", "Root Crop" and "Tree Crop" farming systems. However, it has a high productivity potential in the "*Cereal-Root Crop Mixed*" farming system, where Cassava has the best chances of measurable food security and poverty alleviation benefits from productivity gains.

In the light of these conclusions, this section deliberates on introducing an initiative for food security and poverty alleviation in the OIC member countries in Sub-Saharan Africa through ***an Integrated Cassava Project.*** The primary focus of the project is to increase the productivity of Cassava and the potential of Cassava processing in some OIC member countries in West Africa, which, in turn, could be used as a model in other member countries in the region.

At the initial stage, a pilot project site will be chosen within the *Cereal-Root Crop Mixed* farming system in some villages in one or two OIC member countries in the Cassava belt of West Africa. The project is expected to help farmers in getting improved Cassava cultivators, farming education and extension services and access to improved post harvest equipment to process Cassava at farm level. The rest of this section discusses the three main components of the project.

4.1. Cassava Cultivators

As is indicated in Section 2, the average Cassava yield of fresh roots per hectare in Africa in the past two decades suggested a significant gap between the yield of Cassava harvested under optimal experimental conditions (over 80 tons/hectare) and the average yield harvested by African farmers (around 8-12 tons/hectare). This was due, among other reasons, to some Cassava diseases such as the Bacterial Blight and Leaf Mosaic Virus. These diseases cause the leaves of the Cassava plant to wither, limiting the growth of the roots and, thus, can cause up to 80% crop loss, which is extremely detrimental to the production of subsistence farmers.

Cassava diseases in Africa were rampant in the 1970s, 1980s and early 1990s, but were brought under control following the establishment of the Biological Control Centre for Africa, which investigated biological control for Cassava pests. In this context, the research efforts of scientists at the International Institute of Tropical Agriculture (IITA) and national agricultural research systems in some of the African countries have led recently to a successful control of most Cassava diseases in the continent. This has been done through genetic breeding and the incorporation of resistant genes into highly yielding Cassava varieties, and through an Africa-wide programme of the biological control of the Cassava mealy bug, the IITA has waged a successful war on a devastating pest.

Having freed Africa's most friendly crop “Cassava” from the vagaries of some of the prevailing diseases and pests, the IITA now has many improved Cassava varieties available that are high-yielding and early maturing. The unattractive six tons-per hectare-varieties, which are late maturing have now given way to varieties that yield 20 - 30 tons per hectare in just twelve months (Taye Babaleye: IITA). Between 1970 and 1998 some 206 new varieties of cassava had been released. In one survey based impact study by IITA (Manyoung et al 2000), the impact of these new varieties have been documented. The estimated economic benefits from the employment of these varieties are reported in Table 4.1. The minimum gross economic benefit of the new varieties introduced is around $83/hectare in Benin while the maximum benefit had pf $447/hectare had been realized in Togo. The introduction of these new varieties in Nigeria had been very extensive, over 2.9 million hectares of land were cultivated with 45% advantage in yield per hectare over the local varieties.

Table 4.1
Yiled Advantage and Economic Benefits of Improved Varieties (OIC Member States).

	Area planted		Average yield		Gains due to improved varieties	
	Total (1000 ha)	Improved varieties (%)	Local Varieties (t/ha)	Advantage (%)	Production (1000 t)	GEB*/ha ($US)
Togo	112	14	9	44	64	447
Cameroon	80	38	17	27	141	392
Sierra Leone	48	23	7	71	55	333
Gabon	43	20	5	60	26	313
Guinea	140	21	6	18	32	165
Nigeria	2,950	23	13	45	4,091	142
Chad	45	19	5.5	82	3.8	105
Cote d'Ivoire	270	20	7.5	20	81	90
Uganda	450	36	7	20	228	90
Benin	158	10	7	71	79	83

*GEB is Gross Economic Benefit.

Source: Manyoung (2000)

The IITA has embarked on a campaign strategy to constantly transfer these improved varieties to African research institutions. IITA's new research thrust is pushing cassava yield to more than 40 tons per hectare on the farmers' fields. The new varieties of "Super Cassava" will be available to farmers in a few years' time. Moreover, IITA, in collaboration with the Centro International de Agricultural Tropical (CIAT) in Colombia, has been pushing improved Drought-tolerant Cassava varieties to the drier areas of the Sahel, the Kalahari and the high altitudes of Eastern and Southern Africa.

So far, the adoption by farmers of the IITA-improved Cassava varieties has been gradual in Africa. The experience started in Nigeria and other countries with strong collaboration with the IITA. However, many other African governments have recently shown more interest and rapid multiplication and distribution of the IITA's-improved Cassava varieties. This added a new impetus to the adoption rate by farmers in almost all of Sub-Saharan Africa. For example, following Nigeria, an IITA Cassava multiplication and distribution project, funded by the United States Agency for International Development (USAID), has successfully taken off in Malawi. Also, the FAO/IITA and Eastern and Southern African Rootcrops Research Network (ESARRNET), which is funded by the FAO, aims at spreading the IITA improved Cassava varieties to farmers and covers all countries in East and Southern Africa.

In Nigeria, Benin, Cameroon, Zaire, Ghana, Mozambique, Niger, Guinea, Angola, Rwanda, Uganda, Togo, Tanzania, Sierra Leone and Zimbabwe, there is an assurance of a new wave of Cassava production that will go a long way to improve food security situation and alleviate poverty in the continent. The realisation of this will depend on the individual government's positive approach towards assisting farmers in procuring improved planting materials and educating them on the new processing techniques to eliminate or minimise loss. If farmers in Sub-Saharan Africa sustain the present awareness on Cassava adoption, it is believed that, given adequate government support, the food situation will significantly and quickly improve in the region. The expected growth in cassava production and its market potential in 2005 had been projected by the FAO (See Table 4.2).

Considering all the above, the primary focus of the present "***Integrated Cassava Project***" will be on following a fast track approach by introducing improved high-yielding and early maturing Cassava varieties that are also resistant to the Cassava mosaic diseases and give double the present yield.

Table 4.2
Potential market increase owing to urban growth in the year 2005(1000 mt).

Region/country	Extra Demand in 2005(Percentage)	Production Increase over 1995 (Percentage)
Mozambique	1 642.42	45.66
Guinea	172.91	28.76
Côte d'Ivoire	345.56	22.08
Cameroon	300.49	21.46
Comoros	9.94	20.29
Nigeria	5 168.56	16.46
Senegal	8.94	16.1
Sierra Leone	31.15	14.21
Togo	83.23	13.82
Benin	164.84	12.28
Guinea Bissau	1.32	11.96
Niger	25.93	11.53
Gabon	26.28	11.43
Somalia	3.42	8.55
Chad	21.78	8.13
Uganda	136.25	6.13

Source: www.fao.org/docrep/007/y5287e/y5287e05.htm (Domestic Market Opportunities)

Under the "***Cassava Cultivators***" component of the project, selected resistant genotypes improved Cassava varieties will be deployed quickly and aggressively to farmers replacing susceptible ones through planned demonstrations, on-farm multiplication, and multi-location trails.

The process of selecting and deploying the required resistant genotypes varieties will be carried out in collaboration with the IITA's Cassava breeders. A team of experts will periodically monitor the cultivators and give its feedback to respective field managers.

Since doubling the yield will lead to a Cassava excessive supply, the objectives of the project will be developed to address all the constraints from production to consumption, using the commodity chain approach.

4.2. Post Harvesting: Processing Cassava

Post harvest processing of cassava is important for several reasons:

1) Fresh cassava roots cannot be stored for long, it deteriorates within few days;
2) The roots are bulky, with 70% moisture content, and therefore transportation of fresh roots to urban markets is expensive;
3) The roots and leaves contain significant amounts of cyanide and processing is required to reduce its level to an acceptable level for consumption;
4) Processed cassava can be stored for much longer periods.

The farmers have acquired the fundamental knowledge about the traditional processing techniques, using make shift approach. However, these techniques are laborious and inefficient. For example, hand grating is a very tedious and painful operation. One tonne of fresh cassava generally requires 10 to 15 man day effort (Cock 1985). Women consider grating of peeled cassava roots as one of the hardest aspect of processing.

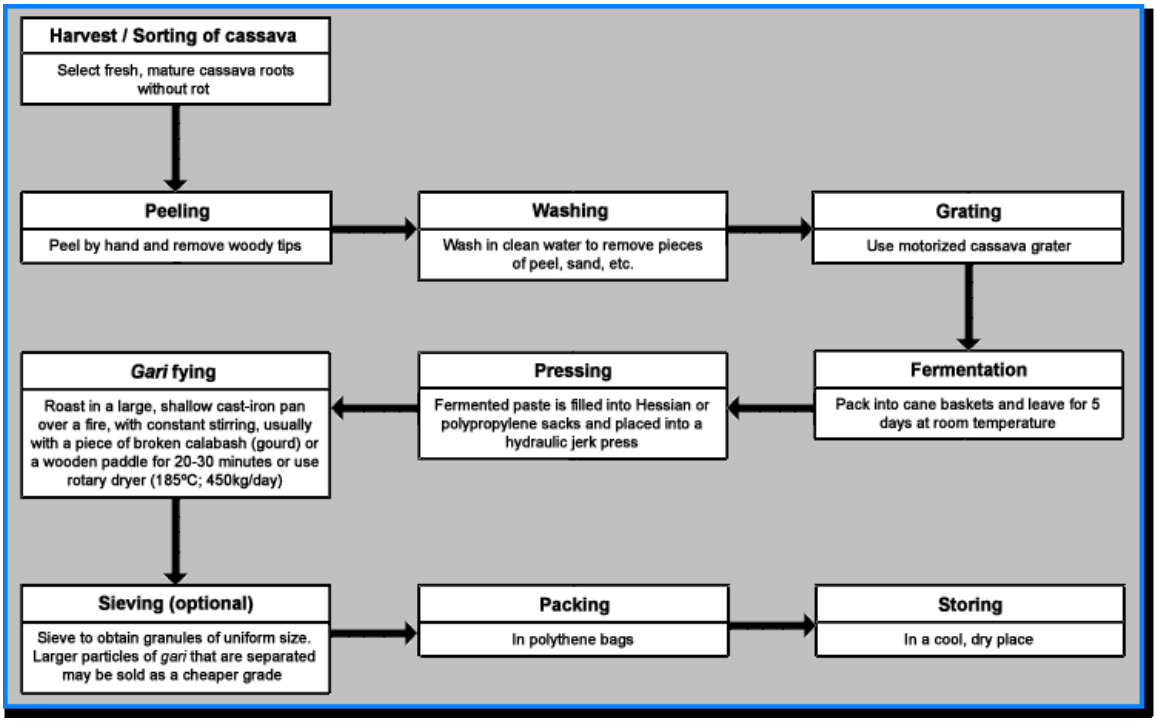
The quality of the traditionally processed products is generally poor and result in poor market value. Better processing methods can improve the well being and health of the rural population through processing efficiency and labor saving.

It has been documented that the profitability of high yielding cassava varieties critically depends on the type of grating method employed. For example the net profit per ton of gari in Nigeria has been reported as follows (Nweke 2003):

Local varieties with manual grating:	US$ 2.5 per ton;
Local varieties with mechanized grating:	US$ 28.0 per ton;
TMS varieties with manual garting:	US$ 20.0 per ton;
TMS varieties with mechanized grating:	US$ 46.0 per ton.

These results indicate the importance of grating techniques together with the high yielding TMS cultivators. Mechanization of harvesting, peeling and toasting operations would further increase the income of the farmers.

Figure 4.1
Improved Cassava Processing Method.



Both mechanical and power based equipment has been developed to improve the post harvest processing of cassava. An improved processing method has been shown in Figure 4.1.

A wide range of Cassava processing techniques exist along with relevant equipment for processing the roots into various Cassava products in Nigeria and elsewhere. The quality,

standards, and specialization of equipment differ by Cassava product, fabricator, and country. Equipment may be designed to produce multiple products, while others are designed for specific Cassava products.

If processed safely, the perishable crop of Cassava can be preserved for up to a year. To preserve Cassava better and still retain most of its nutritional value, it has to be processed with the right materials and using methods that make it safe for human consumption. IITA has developed modern processing methods and equipment to produce safe Cassava products.

Under the "***Post Harvesting***" component of the project, the focus will be more on the expansion of post-harvest processing and marketing outlets by providing the farmers and small and medium-level cassava enterprises with the necessary equipment and training on various cassava utilisation processes.

In a latter stage of the project, establishing a Cassava club or centre in the selected villages could serve as a pilot-processing focal point, where farmers can sell their fresh Cassava production, to turn Cassava into industrial starch and add value to Cassava production in these villages.

Setting up a micro-credit financing system for small and medium-scale Cassava farmers and processors may also be undertaken under this component of the project.

4.3. Extension Services and Farming Education

After the selection of project site/sites, it is important that farmers of the project area are taken into confidence and farmers should get themselves registered in a formal group. The project team should explain to them the details and the expected outcomes of the project.

Dissemination of knowledge to the farmers would be vital for an effective and successful implementation of the cassava integrated projects. Recent experiments of "Farmers Field Schools" have suggested that simple transfer of new agricultural technology through extension is inadequate (Hakiz et al. 2004). In traditional extension systems, farmers are treated as end-users of technology who are being persuaded to adopt the new concepts. Farmers Field Schools (FFS), on the other hand are based on participatory extension methods.

The increase in the popularity of FFS over the past decade has been remarkable (CIP-UPWARD 2003).

In FAO (2002) report, J.Pretty outlines the following key principles of FFS:

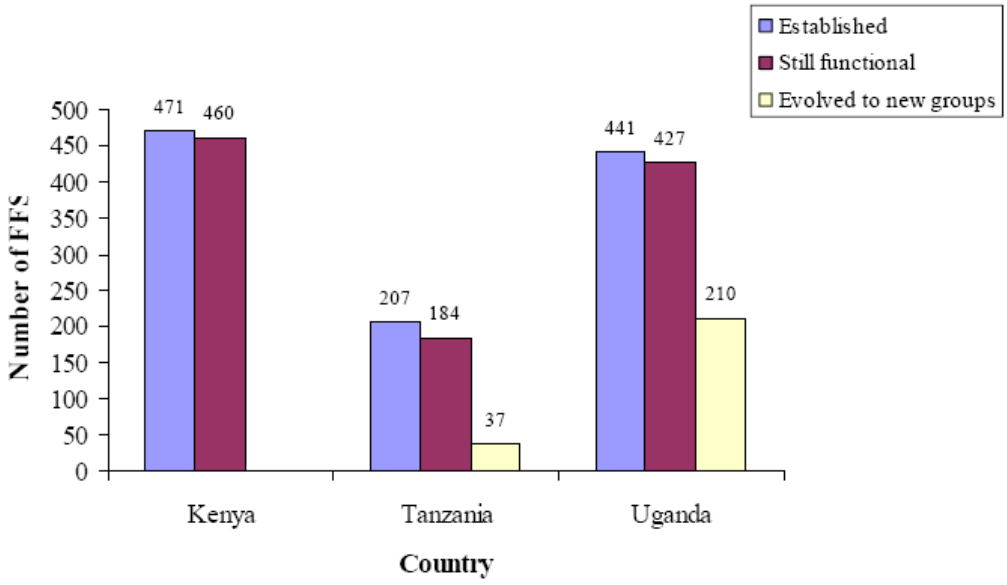
- What is relevant and meaningful is decided by the learner and must be discovered by the learner. Learning flourishes in a situation in which teaching is seen as a facilitating process that assists people to explore and discover the personal meaning of events from them.
- Learning is a consequence of experience. People become responsible when they have assumed responsibility and experienced success.
- Cooperative approaches are enabling. As people invest in collaborative group approaches, they develop a better sense of their own worth.
- Learning is an evolutionary process and is characterized by free and open communication, confrontation, acceptance, respect and the right to make mistakes.
- Each person's experience of reality is unique. As they become more aware of how they learn and solve problems, they can refine and modify their own styles of learning and action.

In this approach farmers learn to develop their intuitive skills and ability of decision making by their better understanding of natural processes. It involves group discussions and interactions with other farmers and therefore it enables better communication skills of the farmers. The farming decisions of one farmer may influence the fields of the other farmers through these interactions. The role of the teacher is to facilitate farmers and generally avoid formal lectures. He introduces the new concepts, explains the process and gets the feedback from the farmers.

The approach of FFS was first introduced in East Africa in 1995 under the FAO special program in Kenya (Braun et el. 2006). Then it has been introduced in other parts of the region. The alumni FFS groups established between 1999 and 2002 with the support of the IFAD and the FAO are still functional (See Fig. 4.3). To date, the FFS network supports 2,000 FFSs with close to 50,000 direct beneficiaries (Okoth et al. 2003).

For the Cassava Integrated Projects, formations of such FFS are being strongly recommended. Teachers and trainers having knowledge of Cassava and its post harvest processing and having experience of the FFS should be part of the project team.

Figure 4.2
Farmer field schools in Africa.



Source: FAO (2006).

Project Summary:

The importance of cassava in food security and poverty alleviation in sub-Saharan Africa is overwhelmingly recognized. In this preamble to a "Cassava Integrated Project", several key aspects of the project have been highlighted:

1) *Selection of the project site*

The region of sub-Saharan Africa has been divided into 15 farming systems (See Map 3.1). The systems relevant to cassava cultivation and majority of the agriculture land of the member states belong to "Cereal Root Mixed", "Root Crop" and "Tree Crop" farming systems with few exceptions, such as, Gabon (Forest Based) and Uganda (High Land Perennial). Given the potential of agricultural growth and poverty, Cereal Root Mixed system should get the priority for this project in the initial phase. However, project can also be simultaneously implemented in the Root Crop system.

The member states in the mentioned farming systems with high potential of cassava productivity improvement are:

Senegal, Guinea, Guinea-Bissau, Burkina Fasso and Gambia (Western Africa);
Sudan (Eastern Africa);

Mozambique (South East of Africa)

2. Components of the project

There are three important dimensions of the proposed project:

- The project will support assistance in procuring the new high yielding cassava cultivators, after consultation with IITA, for the project farmers.

- The project will also assist farmers in post-harvesting processing of the cassava roots. It is feasible to supply portable cassava graters to the individual farmers initially. These graters are available at IITA and they are not very expensive. In the second stage of the project a more comprehensive set of processing equipment can be supplied to a group of farmers.

- Setting up of Farmer Field Schools is also proposed. The services of professional agronomist, with experience with cassava cultivation and post-harvest processing, will be hired. A time schedule of interactions of project farmers and teachers will be announced. Farmers are expected to learn more effective cultural practices of cassava cultivation to ensure significant gains in per hectare yield of the crop. They will also be trained to use post harvest processing of cassava equipment. This will assist farmers in producing better quality cassava products with higher efficiency. This in turn will increase the shelf life of cassava to ensure food security and also will provide opportunity to earn income.

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Appendix

Post-Harvest Processing of Cassava.

Manual peeling of cassava roots

Washing of peeled cassava roots

Grating of cassava

Pressing of cassava grit before drying