MINISTRY OF FOOD AND AGRICULTURE
THE REPUBLIC OF GHANA

THE STUDY
ON
THE PROMOTION OF DOMESTIC RICE
IN
THE REPUBLIC OF GHANA

FINAL REPORT

MARCH 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

PREFACE

In response to the request from the Government of Ghana, the Government of Japan decided to conduct the Study on the Promotion of Domestic Rice and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yuichi FUKASAKA (up to March 2007) and Mr. Naoto MORIOKA (from April 2007) of Nippon Koei Co., Ltd. between June, 2006 and March, 2007.

The team held discussions with the officials concerned of the Government of Ghana and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Ghana for their close cooperation extended to the study.

March 2008

Eiji HASHIMOTO,
Vice President
Japan International Cooperation Agency

March 2008

Mr. Eiji HASHIMOTO
Vice President,
Japan International Cooperation Agency
Tokyo, JAPAN

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the Final Report of the Study on the Promotion of Domestic Rice in the Republic of Ghana. The Final Report was prepared based on the results of the Study conducted for the period from June 2006 to March 2008.

The objectives of the Study consist of (1) preparation of policy recommendations and plan of actions to improve rice production which will include post-harvesting and marketing through improving the competitiveness of rice produced in Ghana; and (2) technology transfer to Ghanaian counterpart personnel through on-the-job training in the course of the Study.

In the Study over twenty two months, rice demand projection indicated that the present rice demand of 460,000 ton per annum will increase to 820,000 ton in 2015, and the basic concept were established to take two steps: the 1st step to maintain the present rice self-sufficiency of 40%, then the 2nd step to make efforts to increase self-sufficiency to 65%. In order to attain the targets, the master plan was formulated as the Integrated Development Programs for each of rice cultivation types through analysis of problems and potential covering the aspects from production to marketing of domestic rice. Then, the action plan was formulated for the priority programs and regions.

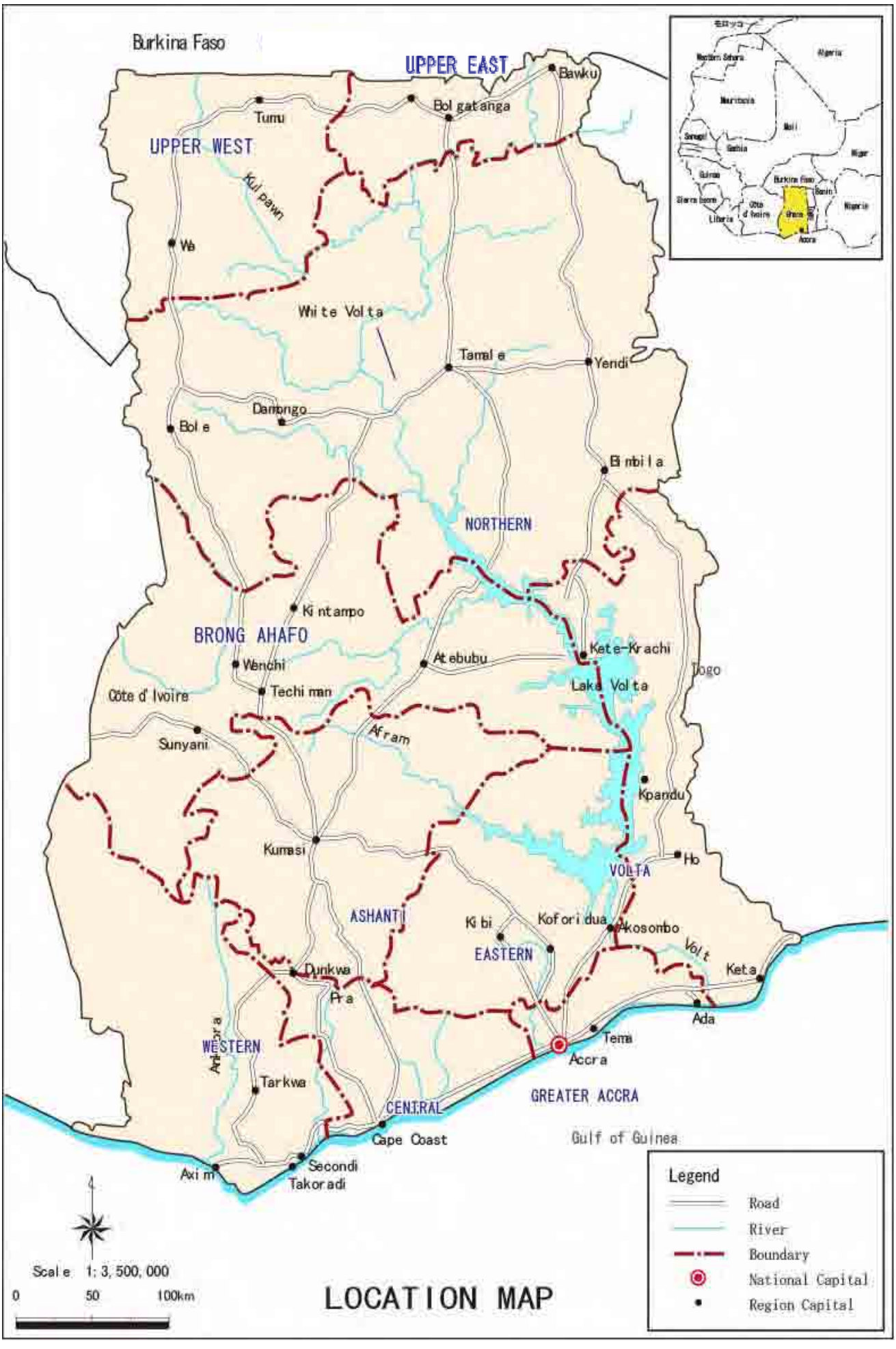
The Study was performed based on continual partnership of the Ministry of Food and Agriculture as well as the central government agencies, regional and district offices, farmer and other stakeholders. Their opinions and intensions were, therefore, incorporated in the plans.

We wish to express our deep appreciation and sincere gratitude to the officials concerned of your Agency, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for the courtesies and cooperation kindly extended to us. We would also like to express our hearty gratitude to the officials concerned from the JICA Ghana Office, the Embassy of Japan in Ghana, the Ministry of Food and Agriculture, regional and district governments, and other stakeholders for the close cooperation and various forms of assistance extended to us during field investigations and studies in Ghana.

Finally we do hope that Ministry of Food and Agriculture will utilized the policy recommendation in the report, and will execute the master plan and action plan successfully along with the promotion of domestic rice as the national policy in order to contribute to welfare of the people and poverty reduction of the local people.

Very truly yours,

Naoto MORIOKA
Team Leader of the Study Team for the Study on the Promotion of Domestic Rice in the Republic of Ghana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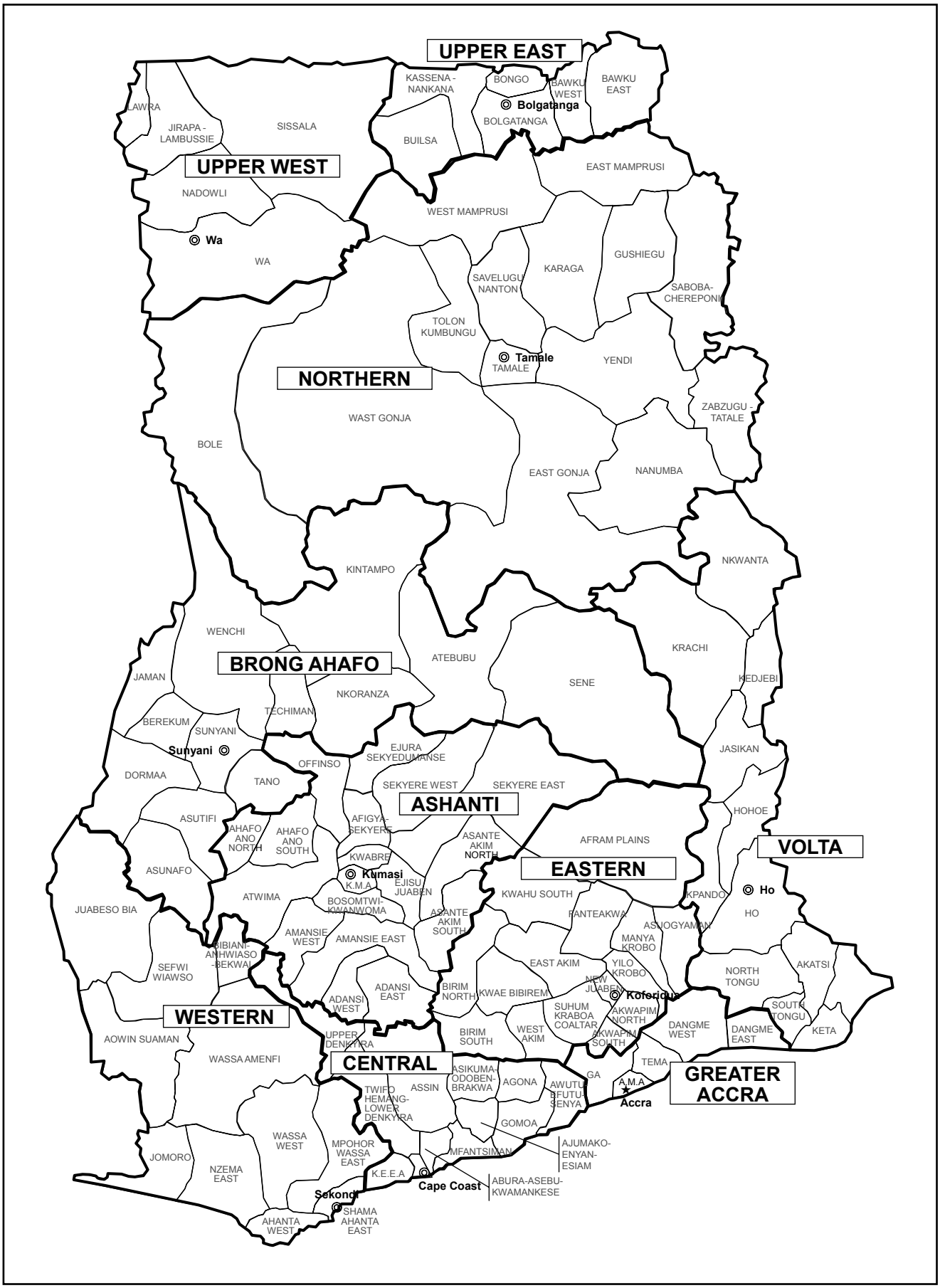


Ghana Administration Map

1. Introduction

Authority

01. This is the Final Report for the Study on the Promotion of Domestic Rice in the Republic of Ghana (hereinafter referred to as "the Study") prepared in accordance with the Scope of Work (S/W) agreed upon between the Ministry of Food and Agriculture, and the Japan International Cooperation Agency (JICA) dated June 30th 2005. *(1.1)*

Objectives of the Study

02. The objectives of the Study are: (i) to make policy recommendation and plan of actions to improve rice production which will include post-harvesting and marketing through the competitiveness of rice produced in Ghana, and (ii) to carry out technology transfer to Ghanaian counterpart personnel through on-the-job training in the course of the Study. *(1.2)*

Study Area

03. The Master Plan (M/P) covers the whole area of the Republic of Ghana, and the Action Plan (A/P) covers the priority areas to be selected in the M/P. *(1.3)*

Study Schedule

04. The Study consists of the Phase 1 (preparation of M/P, 10 months from June 2006 to March 2007) and Phase 2 (preparation of A/P, 12 months from April 2007 to March 2008). In the Phase 1, such issues as development potential and constraints of domestic rice were studies based on the baseline survey covering production, post-harvest and marketing, and the Master Plan was formulated by prioritizing the issues. In the Phase 2, the priority programs and areas were selected and their Action Plan was formulated. *(1.4 – 1.7)*

2. Socio-Economic Condition and Development Plans

Population and Socio-economic Condition

05. The total population of Ghana is estimated at 21.3 million in 2005, and its population growth rate is 2.5% per annum from 2000 to 2005. About 55% of the population lives in rural areas. About 90% of farm holdings are less than 2 ha in size. Poverty is widespread in the country with 43% living below the poverty line. Poverty levels are substantially higher in rural areas, at 62% compared to 28% in urban areas. At the national level, almost 58% of those identified as poor are from households for which food crop cultivation is the main activity. Especially the rural population in the Northern regions of Upper West, Upper East and Northern occupies more than 50% of the group classified as extremely poor. *(2.1)*

06. The country joined the Heavily Indebted Poor country (HIPC) group in 2002, and this has improved Ghana's external debt profile significantly (Table 1). Ghana's economic growth under GPRS-1 (2002-2004) was led by the agricultural sector with 6% of annual average growth rate, followed by industry and services respectively with 5% and 4.7%. The agricultural sector is the most dominant sector of Ghana's economy in terms of contribution

to GDP, export earnings, and employment of the country's labor force. The major export commodities are cocoa, timber and gold. About 40% of the country's total export revenue (US$2,274 million) came from agricultural produce such as cocoa and timber in 2005. On the other hand, about 22% of the country's total import expenditure (US$3,303 million) was for agricultural imports including livestock and fishery commodities. Of the agricultural imports, about 22% was for rice followed by wheat (about 22%) in 2002 to 2004 on average. *(2.1)*

Table 1 Macro Economic indicators of Ghana

Particular	1995	2000	2004	2005
GNI	-	$6.5 bill.	$8.2 bill.	$10.0 bill.
GNI per capita	-	$330	$380	$450
GDP	$5.0 bill.	$6.5 bill.	$8.2 bill.	$10.7 bill.
GDP growth per annum	4.0%	3.7%	5.8%	5.8%
Inflation (*1)		27.2%	14.1%	14.8%
Composition GDP				
(i) Agriculture	38.8%	36.0%	37.9%	38.8%
(ii) Industry	24.3%	25.4%	24.7%	24.6%
(iii) Services	36.9%	38.6%	37.4%	36.6%

Note *1: GDP deflator, Source: Ghana Statistical Services

Land Holding and Tenure

07. Land administration in Ghana is governed by both customary practices and enacted legislation, and are divided into two types of land ownership, i.e. state lands and communal lands. The state lands are defined as lands compulsorily acquired by the government for public use. In contrast, communal lands are in communal ownership, held in trust for the community or group by a stool or skin as symbol of traditional authority or by a family. Seventy eight percent (78%) of the total land area of Ghana belongs to communal lands, 20% to the state lands and 2% to the vested lands. Any decisions taken by the custodian that affects rights and interest in the lands, especially the disposition of any portion of communal lands to non-members of the land holding community, require the concurrence of the principal elders. *(2.2)*

08. In implementation of agricultural development, the following points are taken into account to avoid land problems: 1) Scale of project and identification of boundary of community lands, 2) Preparation of documentation in statutory form for land lease, 3) Improvement of share cropping practices such as Abunu and Abusa, 4) Selection of beneficiaries and scale of farm size. In implementing the irrigation development project, the following issues shall be considered: prompt and adequate compensation and coordination among the related communities by the government land administration institution. *(2.2)*

Government Development Policy

09. According to the Ghana Poverty Reduction Strategy (GPRS-1, 2003-2005), the target is to attain middle income stratus with a per capita income of at least US$1,000 by the year 2015 within a decentralized democratic environment. In order to attain this target, emphasis is placed on changing the structure of the economy by developing the private sector, diversifying the export base and increasing agricultural productivity and rural incomes. *(2.3)*

10. In 2002 "the Food and Agricultural Sector Development Policy (FASDEP)" was formulated to provide a holistic policy framework to modernize agriculture with the linkages from production to marketing as well as with non-agricultural sectors. A sector-wide approach is adopted to manage agricultural development as opposed to the discrete project approach pursed in the past. Under the FASDEP, food security and promotion of import substitution are focused to reduce rice imports by 30% by 2004 through increasing production to 370,000 tons per annum. *(2.3)*

11. However, the production target could not be achieved yet. Based on the progress of FASDEP and the economic growth of the country, the FASDEP II (2007 to 2012) was published in August 2007. In this policy, the priority is given to food security and emergency preparedness of rice, one of the selected five staple crops. *(2.3)*

3. Present Situation of Paddy Production

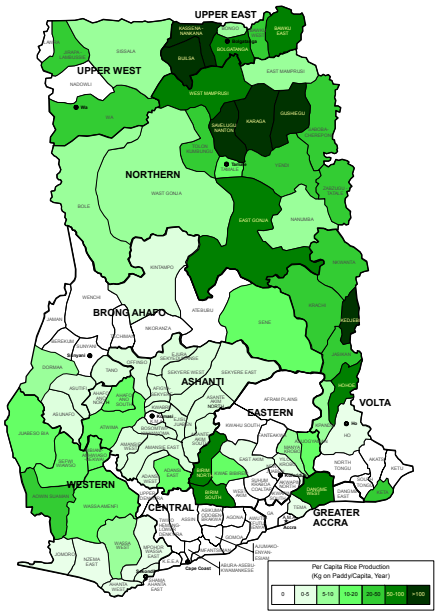
Rice in Food Crop Production

12. The Ghanaian diet is characterized by its diversity. As a result of the rapid change of lifestyle and food habit in urban areas, rice consumption has sharply increased. To make up for shortages of domestic rice, Ghana annually spends over US$100 million for rice imports, e.g. US$1.85 million in 2005. This means that increased domestic rice production will contribute directly to foreign currency savings and balance of payment. Needless to say, increased rice production will contribute also to improvement in the farmers' economy. (3.1)

Rice in Food Crop Production

13. According to the agro-ecological zones (AEZ) defined by the water holding capacity of soils and ratios of rainfalls over evapo-transpiration, the growing period of crops in the central to southern parts of Ghana extends to around 300 days a year. This means that annual crops can be planted nearly throughout the year, while the length of growing period of crops is shortened to 90 days to 120 days a year in the northern part. Root crops can be broadly planted in the central to southern parts of Ghana, while drought tolerant cereals, i.e. millet and sorghum, are planted mainly in the northern parts of Ghana. *(3.2)*

14. The per capita rice production in each region was calculated on the basis of average rice production in 1996 - 2005 and the 2003 population. The results are illustrated in Figure 1. The per capita production in the Northern, Upper East and Volta regions exceeds 20 kg in paddy or 13 kg in rice. In particular, the Northern region exceeds 48 kg in paddy or 31 kg in rice. These three regions produce over 70% of national production. *(3.2)*

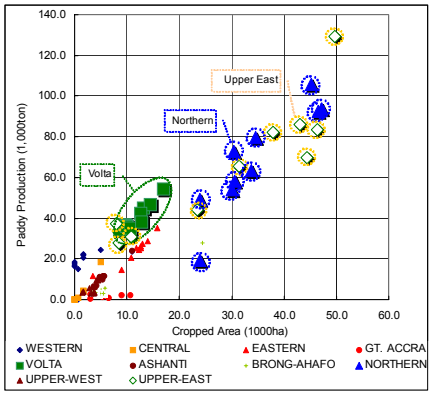


Source: Population Census, and MOFA Statistics

Figure 1 Per Capita Rice Production by District

Planted Area and Average Yield of Rice in Food Crop

15. Paddy production was in the range of 200,000 tons and 300,000 tons with large annual fluctuation, and is strongly affected by those in the three main producing regions, i.e. Northern, Upper East and Volta. The past records indicated that clear correlation is found between paddy production and planted area, and suggested annual fluctuation of planted area can be minimized in order to increase paddy production. Efforts should firstly be directed to improvement of physical and economic environment surrounding rice farmers in order to ensure sustainable rice farming on arable land with increase of unit yield. It is also crucial how to minimize abandonment of rice farming. In this regard, improvement of anticipated profits from rice farming is a central issue for farmers. *(3.3)*



Source: Statistics, Research and Information Directorate (SRID), MOFA

Figure 2 Relationship between Paddy Production and Planted area (1996-2005)

Planted Area and Average Yield of Rice in Food Crop

16. Paddy fields of Ghana consist of three types, as shown in table right. Over 90% of paddy fields including upland paddy fields are planted under rain-fed conditions. Establishment of farming technology and land consolidation of paddy fields is urgently required to improve productivity. Positive impacts are expected to rain-fed paddy production under the development programs of both African Development Bank (AfDB) and French Development Agency (Agence Frensase Development: AFD). *(3.4)*

Table 2 Categorization of Paddy Field in Ghana

	Lowland rain-fed	Upland rain-fed	Irrigated	Total
Planted Area	93,750 ha	18,750 ha	10,200 ha	122,700 ha
Paddy	2.4 ton/ha	1.0 ton/ha	4.5 ton/ha	2.4 ton/ha
Paddy Productio	224,700 ton	18,750 ton	45,900 ton	289,650 ton
% in Area	77%	15%	8%	100%
% in Production	78%	6%	16%	100%

Source: JICA Preliminary Study Report (Sept. 2005) and modified by the Study Team

17. The irrigation development potentials are estimated to be 1.9 million ha. On the other hand, the developed area is limited only to 1.0%. There are 22 public irrigation schemes under the Ghana Irrigation Development Authority (GIDA) since 1960s. The total developed area amounts to 8,700 ha, 5,200 ha (60%) are currently used for production of rice, maize, vegetables, etc. The average paddy yields are 4.2 ton/ha in the rainy seasons and 3.5 ton/ha in the dry seasons, which suggest necessity of further assistance for yield improvement. The planted area of rice has been gradually decreased through crop diversification to vegetables of high value. *(3.5)*

18. Cabinet Information Paper issued on 15th April 2005 stated the program for promotion of domestic rice production with development targets (Table 3) to be achieved by

Table 3 Rice Production Program 2005-2010

Category	Development Area	Paddy Yield	Paddy Production
Lowland & Inland Valley Rice	19,000 ha	4.0 ton/ha	76,000 ton
Irrigated Rice	6,000 ha	5.0 ton/ha	30,000 ton
Total	25,000 ha		106,000 ton

Source : MoFA

2010. New development of lowland and inland valley rice is planned in Hohoe, Jasikan, Kpandu with a total coverage of 7,000 ha under IVRDP, 2,000 ha of extension and 10,000 ha in the northern country under EU/AFD. Extension of existing irrigation schemes is planned in both Aveyime in the North Tongu district of the Volta region and Kpong in the Kpong district of the Greater Accra region with a total extension area of 6,000 ha. *(3.4)*

Farm Management of Rice

19. Multiplication and distribution of certified seeds are not operational under the nation-wide programs controlled by the Government. In almost all cases, certified seeds are produced to a limited extent within the framework of individual projects and programs. As a result of recurrent use of home-made seeds for years, productivity and quality of seeds tend to have deteriorated at the farmers' level. The mixture of off-type variety seeds and damaged seeds is outstanding. Variety trials for NERICA have been conducted during the period from 2004 to 2006 by JAICAF in several sites in Ghana including Crop Research Institute (Kumasi), Savanna Agricultural Research Institute (Tamale) and Ashiaman Irrigation Scheme (Greater Accra) *(3.6)*

20. According to the rainfall distribution, bi-model of rainfall pattern is prevailing in the southern and middle area, while a single rainy season is dominant in the northern area. Under the rain-fed conditions, the rainy season paddy is transplanted in April to May with seedlings of 30 days old and harvested in July to September. In parallel to harvesting of the rainy season paddy, dry season paddy is planted in the inland valley. The double cropping of paddy is partly practiced under the irrigated conditions. Due to lack of agricultural machinery and delayed procurement of farm inputs, the crop seasons are incidentally delayed by three months at a maximum. *(3.6)*

21. Under the irrigation condition, land preparation starts at the beginning of rainy seasons by plowing and puddling by tractor. Extension workers of MOFA advise farmers to incorporate weeds into soils thoroughly. Seedlings are grown in nurseries for 30 days and transplanted with space of 30 cm x 15 cm to 20 cm x 20 cm. Basal dosage is applied at 300 kg to 400 kg of the NPK compound fertilizer 15-15-15 per ha. Top-dressing is given with Sulfate Ammonium (N21%) at panicle formation stage of rice on 21st day after transplanting. *(3.6)*

22. Under the rain-fed condition, direct sowing is commonly practiced. Plowing and harrowing are practiced by tractor. In the Northern region, bullocks-drawn ploughs are introduced for rice farming. Dry seeds are sown either in line or broadcasted at the beginning of the rainy seasons, by dibbling or broadcasting. Healthy germination and seedling establishment are encouraged by rainfalls after direct-sowing. Seeds in soils are sometimes damaged if rainfalls are delayed. Bird damage is also common. Weed control is crucial in direct sown paddy fields. Farmers do manual weeding in the first two months after sowing. Agricultural extension advises on the use of herbicides before and immediately after sowing. In the semi-humid central to southern zone, transplanting is practiced, although its extent is not known. *(3.6)*

Rice Farming Type and Financial Analysis

23. Baseline survey was conducted to clarify the current situation on farmers' activities in five regions of the Upper West, Northern, Ashanti, Western and Volta. The results indicate 1) average farm size is 2 to 3 ha in the southern area, and 5 to 8 ha in northern area, 2) cropping intensity under rain-fed condition 51% to 74% in the southern area and 33% to 41% in the northern area, 3) average yield: 0.9 to 3.2 ton/ha under the rain-fed condition and 1.5 to 6.3 ton/ha. Based on the result of baseline survey, rice farming system is categorized into three types in terms of farm techniques and paddy yield. *(3.8)*

Table 4 Typical Rice Farming Systems of Ghana

	Type 1 Irrigated rice	Type 2 Semi-intensive rain-fed rice	Type 3 Low input rain-fed rice and upland rice
Purposes	Cash income	Cash income and home consumption	Home consumption and cash income
Present paddy yield	4.0 - 5.0 ton/ha	1.0 ton/ha - 3.0 ton/ha	0.5 ton/ha - 1.5 ton/ha
Target paddy yield	6.0 ton/ha and more	3.0 to 4.0 ton/ha	2.0 ton/ha
Water sources and irrigation facilities	GIDA irrigation schemes	Rainfalls with supplemental irrigation	Only rainfalls
Land consolidation: bunds and leveling	Bunds and land leveling acceptable for rice farming	Bunds and land leveling acceptable for rice farming	Bunds are not constructed and land leveling quality is poor.
Farming practices	Transplanting, mechanized farming practices, shortage of machinery hindering cropping system.	Direct seeding by dibbling, tractor hire services for land preparation or power tillers, manual harvesting manually.	Broadcasting, land preparation by either tractor or draft animals on demand.
Fertilizers and agro-chemicals	Use of fertilizer and herbicide	Use of fertilizer and herbicide	Rarely used
Agricultural credits	Utilized	Utilized	Not utilized or not accessible
Post-harvest	Processed at rice mills attached to the irrigation schemes	Processed by Engelberg or on-pass small rice mill	Pounding
Site visited	ICOUR (Tono, VEA) Upper East、Ashiaman	Vicinity of Kumasi and Tamale	Vicinity of Tamale

Source: Baseline survey (2006), JICA study team

Type 1 : Irrigated rice

Intensive rice cultivation is operated in the irrigation schemes developed by GIDA. Farmers can obtain such services as agricultural credits, tractor hire services, rice milling and market access. High production cost is one of the major constraints. Paddy yield improvement and quality control are required. (Photo : Tono Irrigation Scheme)

Type 2 : Semi-intensive rain-fed rice

Semi-intensive rain-fed rice farming is managed in the vicinity of such urban centers as Kumasi and Tamale. Paddy fields are developed on such low-lying land as inland valley bottoms. Supplemental water sources are often utilized, and yield level is as high as 4.0 ton/ha. Farmers are keen to access the market to generate cash income from rice. (Photo : SAWAH project in Kumasi)

Type 3 : Low input rain-fed rice and upland rice

Rice is cultivated under marginal agro-ecological conditions. Low input rice cultivation reduces financial risks though paddy yield as low as 1.5 ton/ha. Mixed cropping with other upland crops is observed. No bunds are constructed and land leveling quality is very low. (Photo : Tamale)

24. The cost-benefit analysis of each rice farming type is presented below:

Table 5 Cost-Benefit by Rice Farming Type

Item	Type 1 Irrigated Rice ICOUR (High Profit)	Type 1 Irrigated Rice ICOUR (Average)	Type 2 Semi-Intensive Rain-fed Rice (Akpafu Odomi)	Type 3 Low Input Rain-fed Rice and Upland Rice (Daffiama)
Unit Yield	6.0 ton/ha	4.0 ton/ha	2.6 ton/ha	1.26 ton/ha
Price	2,200 cedi/kg	2,200 cedi/kg	2,850 cedi/kg	2,860 cedi/kg
Gross Income	13,200 10^3 cedi/ha	8,800 10^3 cedi/ha	7,410 10^3 cedi/ha	3,600 10^3 cedi/ha
Production Cost	9,930 10^3 cedi/ha	7,610 10^3 cedi/ha	6,085 10^3 cedi/ha	2,910 10^3 cedi/ha
Net Profit	3,270 10^3 cedi/ha	1,190 10^3 cedi/ha	1,325 10^3 cedi/ha	690 10^3 cedi/ha
B/C	25%	14%	18%	19%

Source: Baseline Survey (2006) and Supplemental Survey, JICA Study Team.

Rain-fed rice cultivation maintains better B/C than Type 1 (Average) since production cost is quite low, however. Due to largely fluctuating rainfall conditions, the benefits are not guaranteed in drought years. Stabilization of paddy yield is the utmost important issue for farmers to reduce the risks in farm management. *(3.8)*

4. Post Harvest and Processing

Flow of Post Harvest of Rice

25. Under the rain-fed condition, small scale farmers conduct manual harvesting and threshing, and slashing position at harvest differs from threshing methods. Panicles, stacked on the floor and threshed by beating of bar, are cut about 40 cm upper part from the ground. In other case, panicles, beaten to oil drum to thresh, are cut near ground. *(4.1)*

26. In semi-humid areas in the southern country, drying process after harvest is often disturbed by rains and high humidity. Under such conditions, grains are easily deteriorated and colored due to high moisture content and bacterial infection. *(4.1)*

27. Though some of the dried paddy is purchased by traders such as Market Mammy at drying yard or farm gate, most of the paddy is kept by each farmer till milling or selling time. Paddy grains are normally stored by individual farmers. Paddy is put into plastic or jute bags with a capacity of 80 to 85 kg. These bags are piled up in storage facilities with an earthen floor. *(4.1)*

28. In middle and northern country harvesting is carried out in the dry month. In this season, air temperature rises very high and humidity drops down, then, the moisture content of panicles before harvest decreases rapidly down to 10% or below the optimum moisture content. This results in unequal moisture distribution in grains, causing cracks of grains in husk, finally high content of broken rice. *(4.1)*

29. Rice milling in Ghana is made on contract or custom bases, getting milling charge in reward for their rice processing work. Revenues from rice milling are the milling charges and income from by-products sale such as rice bran, husk and fine broken rice, etc. Income from by-products sales belongs to client or millers, or divided by client and millers depending on locality. *(4.1)*

Rice Quality in Market

30. Through the baseline survey in five regions of the Upper West, Northern, Ashanti, Western and Volta, milled rice samples were collected in the local markets and analyzed based on the Ghana Standard. The results are shown in the following table. *(4.2)*

Table 6 Grade Distribution of Domestic and Imported Rice

Grade	1st	2nd	3rd	4th	5th	N.A.
Domestic Rice	0.0%	4.3%	6.5%	5.4%	82.6%	1.1%
Imported Rice	5.5%	50.9%	16.4%	10.9%	16.4%	0.0%

Source: Baseline Survey 2006, JICA Study Team

Analysis standard: Standard for Classification: Cereals, Pulses and Legumes - Specification for Rice. GS 765: 3003, Ghana Standard Board

Present Situation of Modern Rice Mill Plant

31. Both Aveyime rice mill in the Volta region and Nasia rice mill in the Northern region are the most modern rice mills with high processing capacity in Ghana, however, both rice mills are not operated due to limited supply of paddy. *(4.3)*

5. Present Situation of Rice Marketing

Rice Marketing Quantity

32. Rice supply volume is estimated at 113,000 ton, after deducting 43,000 ton of self-consumption of farm households from 156,000 ton of total rice production (average 2000 to 2003). According to "GSS Ghana Living Standards Survey" made in 1999, the sales share of product is estimated at 42% on average. Based on this figure, self-consumption is estimated at 66,000 ton, and disstribution volume of domestic rice is estimated at around 47,000 ton which accounts for 11% of total rice marketed (409,000 ton) considering imported rice (362,000 ton) in the country. *(5.1)*

Table 7 Rice Distribution (2000 - 2003)

Unit: 1,000 ton (milled rice)

	Production	Seed & Loss etc.	Self-consum-ption	Distri-bution	Propor-tion
Local	156	43	66	47	11%
Imported	-	-	-	362	89%
Total				409	100%

Source: FAOSTAT

33. Based on the results of the baseline survey, per capita rice consumption is estimated at 38.0 kg in urban area, 9.2 kg in rural area, and 22.1 kg on average. *(5.2)*

Table 8 Estimation of Rice Per-capita Consumption of Rural Population

Area		Urban	Rural	Whole Country
Population		9,170,000	11,360,000	20,530,000
Yearly Consumption	Per capita	38.0 kg	9.2 kg	22.1 kg
	Total	348,500 ton	104,800 ton	453,300 ton
	Consumption Ratio	76.9%	23.1%	100.0%

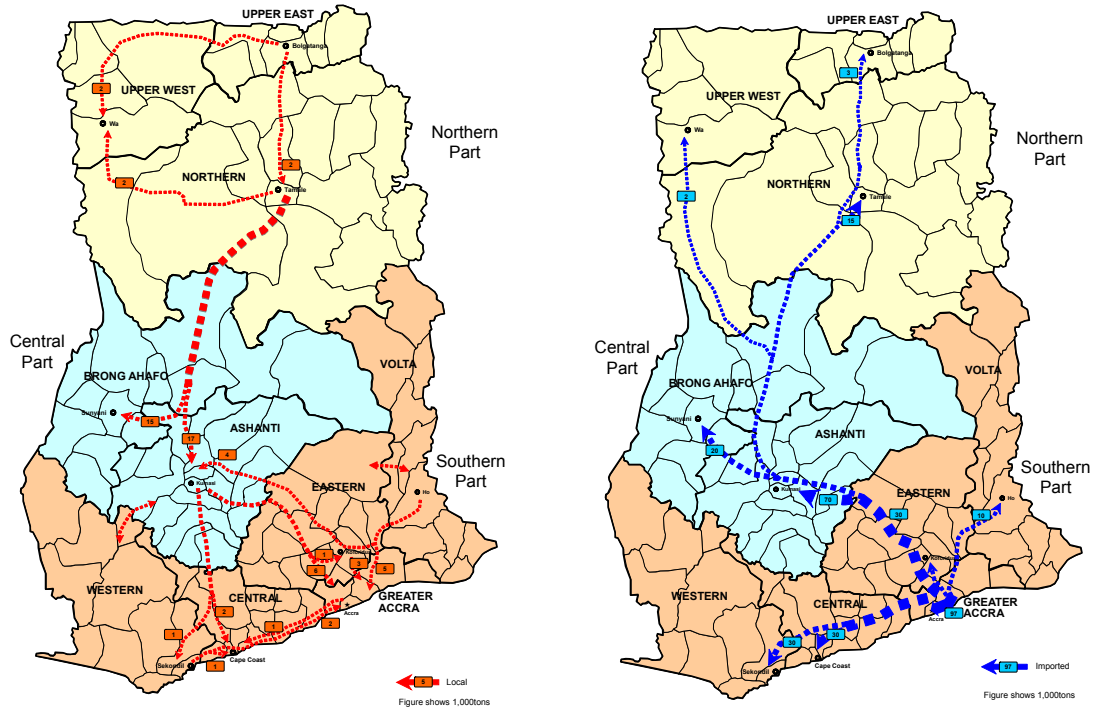
Source: estimation based on the interview survey by the JICA Study Team, 2006.

Rice Distribution Channels and Quantity

34. Based on the results of the baseline survey and market survey, rice distribution channel of domestic rice and imported rice. In the southern area, imported rice is predominant under the limited production and marketing of domestic rice. A limited volume of local rice is traded beyond the regions.

The central areas are large rice consumption areas, and about 32,000 ton of surplus rice in the northern areas is brought to the central areas. Kumasi is a large consumption area for domestic rice from the northern areas and from the Western and Volta regions. Kumasi is located at the center of domestic rice trading as a crossing point between the vertical distribution flow from the northern areas and the horizontal distribution flow from/to the Western and Volta regions.

The northern area is rice surplus area, and people traditionally consume parboiled rice and the majority of rice locally produced is processed to parboiled rice. However, imported rice is widely consumed at most restaurants and hotels, and many imported rice including a little imported parboiled rice can be seen in the urban markets. *(5.3)*



Domestic Rice Imported Rice

Figure 3 Major Rice Distribution Channels and Quantity in Ghana

(Source: JICA Study Team)

Rice Preference and Trend

35. The survey to consumers on rice prefernce is carried out, with a supplemental interviews in the four biggest cities. The result indicated 1) Consumers in urban area prefer imported rice of perfumed long grain, 2) Average frequancy of rice dishes: 4.3 times in a week, 3) Selection of rice based on quality rather than price. Important factors in purchaseing rice are absence of impurities of stones (22%), uniformity of grains (18%), less broken rice

(15%), taste (12%) and price (10%). The factors of uniformity and less impure rice share a half and more, and the share including the factor of taste becomes 60%.

In conclusion, consumers think that rice is convenient for cooking and good for health, and prefer good appearance with well polished and unified grains as well as the long grain and perfumed rice because of enlarging volume after cooking and its taste. *(5.5)*

6. Problem Analysis

Participatory Problem Analysis Workshop and Structural Assessment

36. Workshops for problem analysis were held to search improvement directions for solving constraints in rice sector, inviting such stakeholders as the government staff, rice producers, consumers, rice millers, traders and retailers. The main issues raised in the workshop are 1) insufficient supply of domestic rice in the urban area, 2) shortage of information on domestic rice, 3) no strains on imported rice by consumers, 4) rice taste governing factor for selection of variety, and 5) importance on rice dietary habit.

In order to formulate a Master Plan for a competitive domestic rice sector, schematic assessment on constraints in production, post-harvest and marketing fields was made based on the current condition of respective stakeholders and technical analyses. *(7.2~7.3)*

Problems in Paddy Production

37. The Study firstly discussed the problems of rain-fed rice farming which provide the livelihood to over 90% of rice farmers in Ghana. The problem structure was analyzed for the core problem "low progress of rain-fed rice development" on the basis of lesson learnt from the above-mentioned programs, as presented as a problem tree below. *(7.4)*

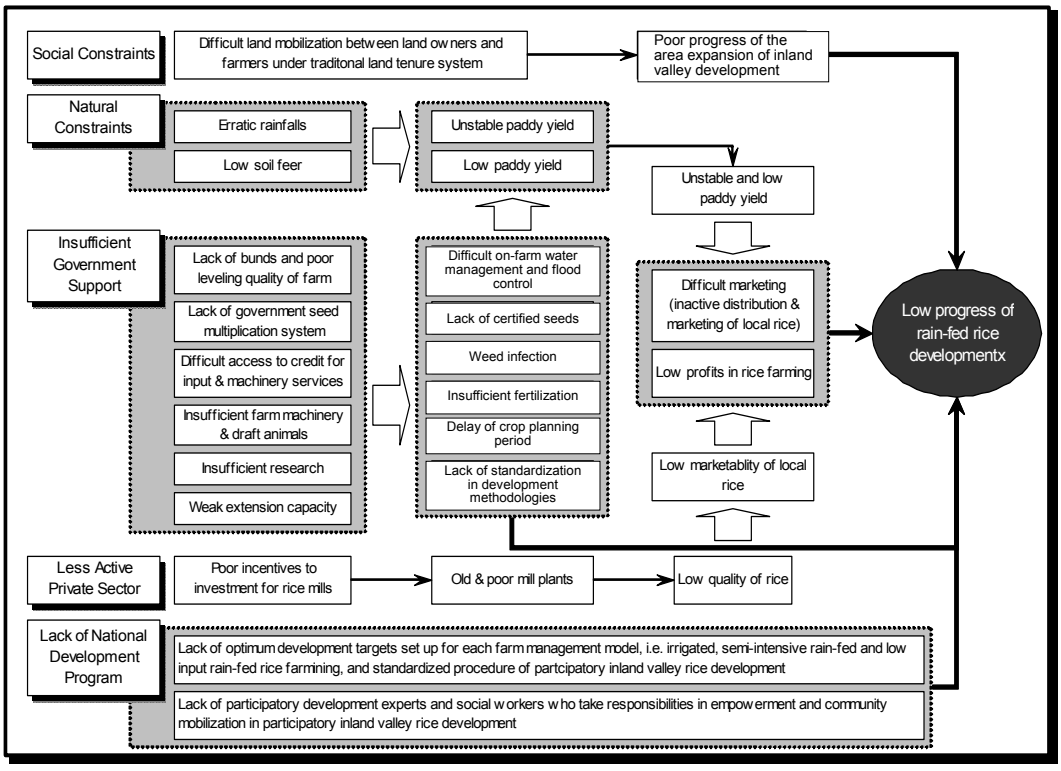


Figure 4 Schematic Problems in Rain-fed Rice Development

Problems in Post Harvest

38. The problem analysis was made to identify prevailing causes of low quality of milled rice. The study paid special attention to (1) low quality of paddy due to delay of harvesting and (2) low incentive of rice millers to improvement of milled rice quality from both technical and management points of view. *(7.5)*

Problems in Marketing

39. In due consideration of the present condition of the rice industry in Ghana, the problems in the field of rice marketing and the subjects to be considered concerning each problem are clarified and compiled in the figure below: *(7.6)*

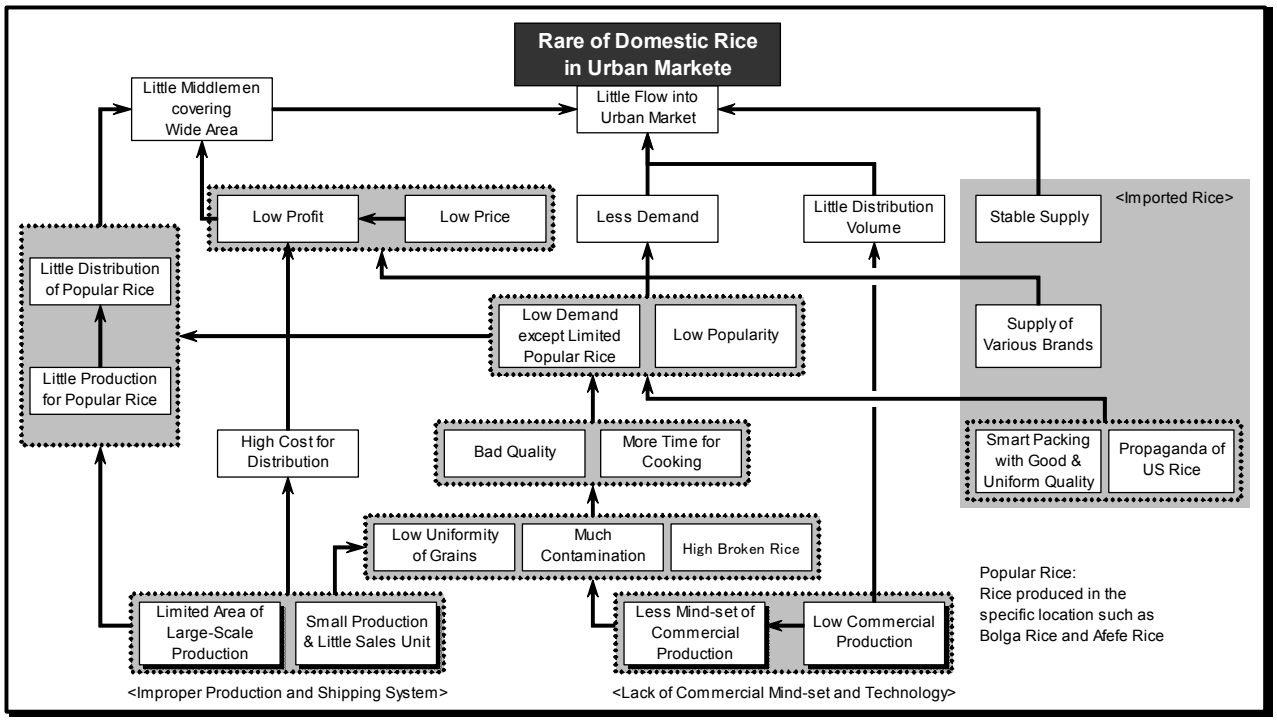


Figure 5 Schematic Problems in Rice Distribution and Marketing

7. Master Plan

Objectives of the Master Plan

40. On the basis of the problem analysis on paddy production, post harvest and marketing, the Master Plan is to be prepared with the following particular objectives: *(9.1)*

- To promote sustainable rice cultivation for increased rice production and poverty reduction;
- To encourage quality improvement of local rice to be supplied to anticipated urban markets; and
- To improve economic environments to ensure smooth distribution and marketing of local rice.

Basic Strategy for the Master Plan

41. The Study will prepare development programs which directly contribute to increased rice

production and poverty reduction attaching the development priority to rice farmers. Rice farmers are categorized into three (3) on the basis of the purposes of rice production.

Type-1 : Irrigated rice farmers, who produce market-oriented high quality rice for urban consumers

Type-2 : Rainfed rice farmers, who produce rice mainly for home consumption, and sell surplus of rice of relatively good quality rice to urban and rural markets

Type-3 : Rainfed rice farmers, who produce rice with low inputs mainly for home consumption

The rice distribution channels are generalized as illustrated in figure below. Three typical flows are identified from farmers to consumers. *(9.2)*

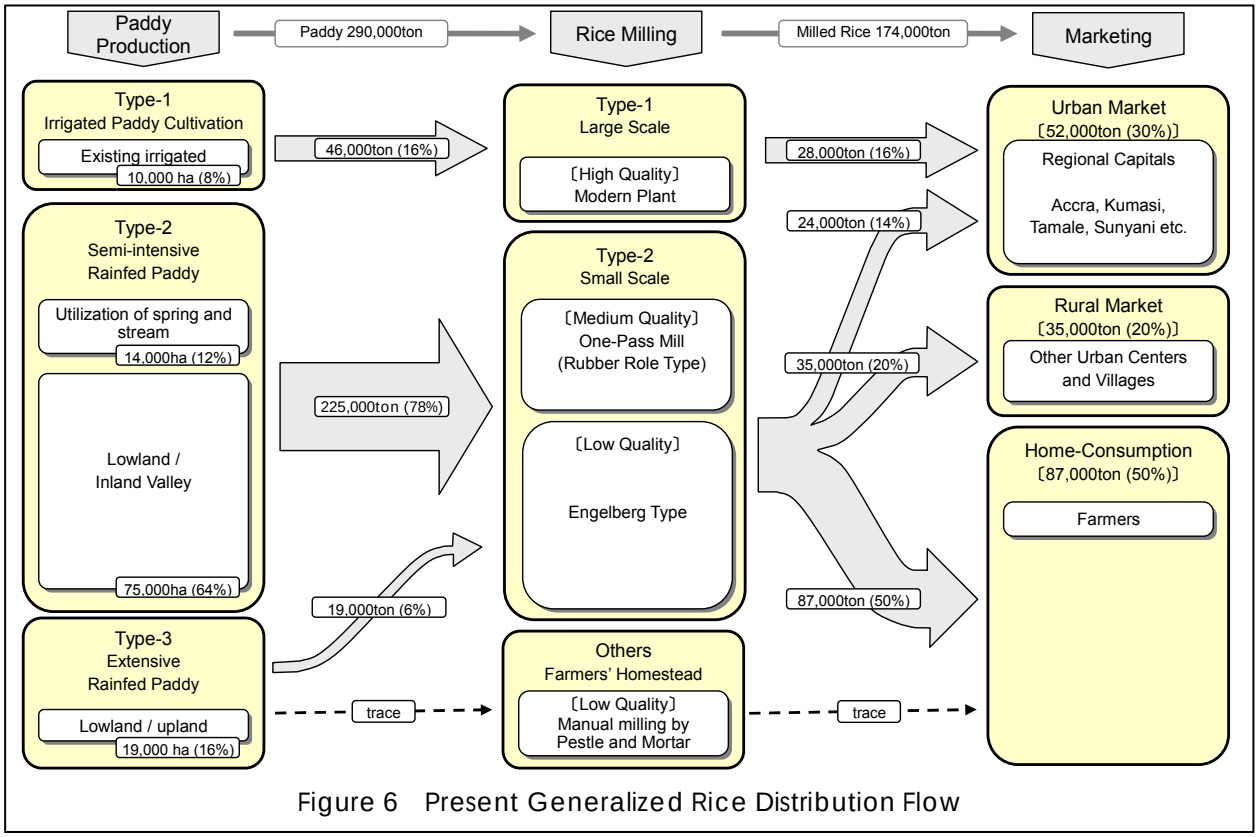


Figure 6 Present Generalized Rice Distribution Flow

42. The basis strategy of the Master Plan is preliminarily set up for each of three flows. As mentioned above, all the development components are integrated under each strategy. They are summarized below. *(9.2)*

Basic Strategy-1: Production and marketing of quality rice, which is competitive to imported rice in both price and quality, will be integrally promoted. To produce quality rice constantly, quality control of paddy grains on farm will become a crucial issue in the irrigation schemes. Expansion of irrigation area is also a prerequisite for increased rice production. Possible government support to private rice millers will be studied to ensure improvement of their service quality.

Basic Strategy-2: Integrated program for semi-intensive rain-fed paddy cultivation, which covers 78% of whole domestic rice production, will be set up. Profitability of farmers will be stabilized and expanded. Firstly, physical works to improve the quality of lowland

paddy field will be considered paying special attention to water control measures and leveling of soil surface. Secondly, yield improvement and production cost saving will be focused.

Basic Strategy-3: Rice farming for home consumption will also be assisted. Although the extent is limited to 16% of the total paddy fields of Ghana, some farmers continue 'low input - low return' rice cultivation at subsistence level under marginal agro-ecological conditions. The development approach required is to mobilize low yielding rice cultivation for the purposes of food security at individual farmers' level. The program will promote introduction of drought-resistant varieties such as NERICA and promotion of simple paddy storage.

Rice Consumption Trend

43. The import amount of rice in the international market has been gradually increasing from early 1990s, and African countries have also been increasing rice imports. This increase of rice imports is partially caused by population increase, and mainly sustained by favorable economic growth which accelerated rice consumption but domestic production cannot grow at the same rate of demand increase. Western African countries show the same increasing trend of rice imports, accounting to two thirds of African rice import.

Rice imports in Ghana, as shown in Figure 7, have been increasing from 200,000 ton (grain, equivalent to 120,000 ton of milled rice) in early 1990s to 800,000 – 1,000,000 ton (500,000 – 600,000 ton in milled rice) in 2003 – 2005, and the import value exceeds US$200 million. This is mainly due to higher economic growth, beginning in the early 2000s. *(9.3)*

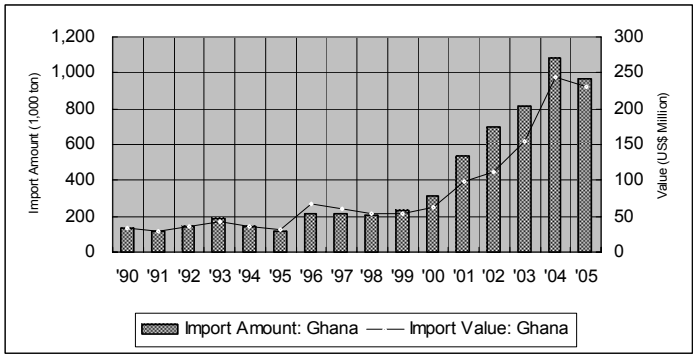


Figure 7 Rice Imports by Ghana
(Source: FAOStat)

44. Regarding the per capita consumption of staple food in Ghana, only rice shows a rapid increase while other grains and foods are almost stagnant.

This is mainly due to the two main factors of (1) high demand in urban area where people prefer easy-cooking, and (2) preference by the younger generation which dominates the total population at about 50%. Unless the economic growth slows down at the present level, this situation will continue. *(9.3)*

Rice Demand and Supply Projection

45. Annual per capita rice consumption during 1999 to 2001 was 17.5 kg on average, and this was increased at 22.6 kg on average during 2002 to 2004. Based on the trend of per capita consumption and population increase, future rice demand was projected as shown below.

Table 9 Rice Demand Project in Urban and Rural Areas

	Annual Average in 2002 – 2004			Projection in 2015		
	Population	Per capita Consumption	Total Demand	Population	Per capita Consumption	Total Demand
Urban	9.2 million	38.9 kg per annum	360,000 ton	11.9 million	52.8 kg per annum	630,000 ton
Rural	11.3 million	9.4 kg per annum	100,000 ton	14.8 million	12.9 kg per annum	190,000 ton
Total	20.5 million	22.6 kg per annum	460,000 ton	26.7 million	30.7 kg per annum	820,000 ton

Source: Estimation by the JICA Study Team

Based on the above projection, rice production is estimated from the supply side. Rice productivity is assumed to increase from the present 2.5 ton/ha to 3.5 ton/ha in 2015. Taking the government plan, rice production area will increase by 36,000 ha, consisting of 6,000 ha for irrigated rice farming system (Type 1), 19,000 ha for semi-intensive rice farming system (Type 2), and addition of 11,000 ha for extensive farming system under rain-fed and upland (Type 3).

Table 10 Future Supply – Demand and Requirement of Rice Development

Item	Annual Average in 2002 – 2004	Projection in 2015 Population + Per Capita Growth (30%)	
		Import Amount at the Present Level	Import Ratio at the Present Level
Rice Demand			
・ Rice	460,000 ton	820,000 ton	820,000 ton
・ Paddy grain equivalent	770,000 ton	1,370,000 ton	1,370,000 ton
Import (paddy grain)	480,000 ton	480,000 ton	830,000 ton
(import ratio)	(62%)	(35%)	(61%)
Domestic Production			
(self-sufficiency)	(38%)	(65%)	(39%)
・ Paddy production	290,000 ton	890,000 ton	540,000 ton
・ Average yield	2.5 ton/ha	3.5 ton/ha	3.5 ton/ha
・ Production Area	118,000 ha	254,000 ha	154,000 ha
(area increased)	(-)	(136,000 ha)	(36,000 ha)

Note: Total production area and unit yield in 2015 is 1) 16,000 ha at 5.0 ton/ha in Type 1 (intensive: irritation), 108,000 ha at 4.0 ton/ha in Type 2 (semi-intensive: inland valley and lowland), 30,000 ha at 1.0 ton/ha in Type 3 (extensive: lowland and upland under rain-fed). Overall production of 540,000 ton (grain) comes from 154,000 ha in production area at the average unit yield of 3.5 ton/ha.

Source: Estimation by the JICA Study Team

In the case of future demand by "population increase" and "per capita increase", production area will require another 100,000 ha of rice production area in addition to the present government plan (36,000 ha) in order to sustain the present rice import amount (without increase of import).

The current government plan is targeted in 2012, and additional expansion of cultivated area may be expected. Even though, it is not realistic to assume to expand the rice production area to 254,000 ha in 2015 (more than 2 time of the present level) taking the current performance into account. In this case, it is proposed to take 2 steps for the attainment, the 1st Stage: sustain the current self-sufficiency level of about 40% in future, and the 2nd Stage in near future: improve the self-sufficiency level to approach near to the 65% level in 2015. *(9.3)*

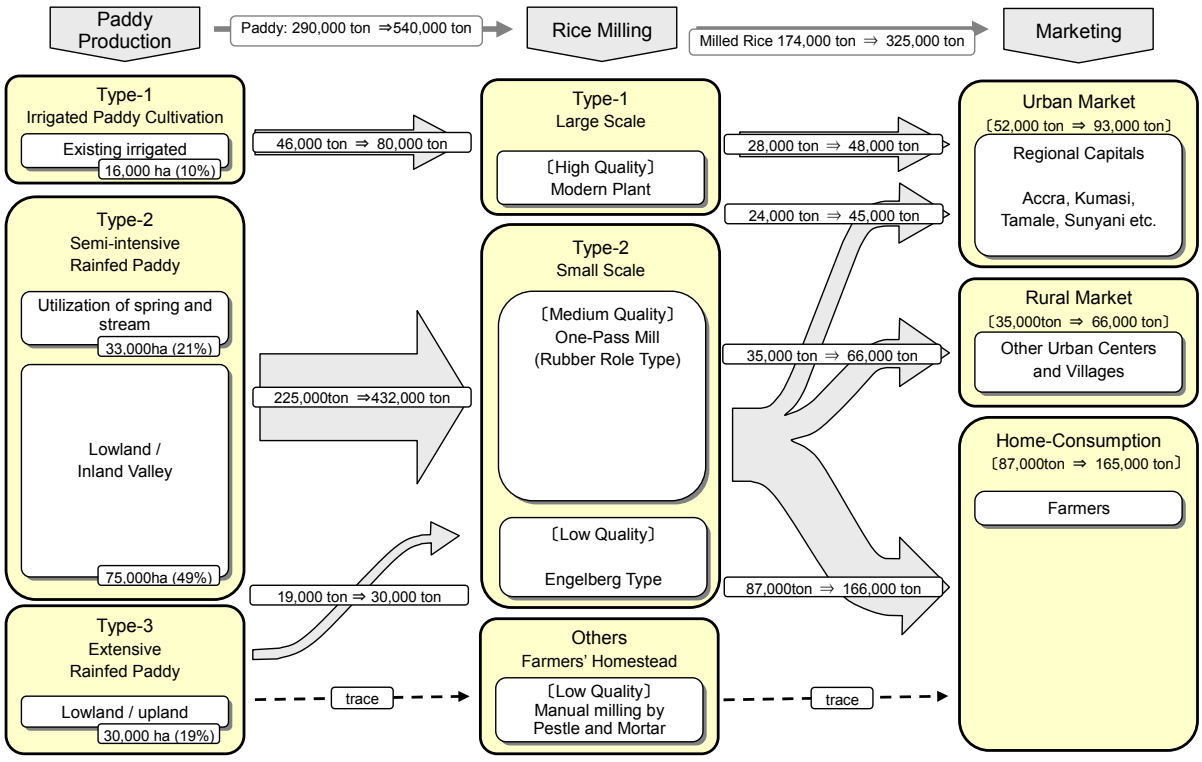


Figure 8 Generalized Type-wise Concept from Production to Consumption

Integrated Development Program and Development Component

46. Various components for development promotion according to the basic strategy described above are defined as development components. In the Master Plan, it is required that various development components under each strategy are proposed as comprehensive development program. Comprehensive development program and development components are shown in the table below. *(9.4)*

Table 11 Integrated Development Program and Development Components

Program	Target Group	Development Components
1. Marketing Driven Rice Enhancement Program	- All rice farmers in the existing GIDA irrigation projects - Newly participated farmers for irrigated rice cultivation - High efficiency rice mill plants or one-pass rice mills (rice mills, located in irrigation projects and nearby rice millers) - Brokers selling and collecting paddy grains harvested from the irrigated paddy fields	1-1 Rehabilitation and expansion of existing irrigation schemes (including optimization of cultivation right and land rent) 1-2 Participatory irrigation development (including support service for activities of farmers groups) 1-3 Improvement and extension of appropriative farm mechanization 1-4 Production cost saving of paddy 1-5 Production and distribution of quality rice seeds 1-6 Quality improvement of milled rice 1-7 Improvement of rice marketing information network 1-8 Enlargement of domestic rice consumption and marketing

Program	Target Group	Development Components
2. Rain-fed Rice Promotion Program (Semi-Intensive Rain-fed)	- Farmers, who manage rainfed rice cultivation in lowland and inland valley areas (estimated 75,000 households) - One-pass rice mill (Engerbarg rice mills are not targeted) - Brokers selling and collecting paddy grains harvested from rain-fed paddy fields	2-1 Field improvement for semi-intensive rainfed rice farming (including optimization of cultivation right and land rent, and support service for farmer group activities) 2-2 Improvement of semi-intensive rain-fed rice farming 2-3 Community-based rice seed production and distribution 2-4 Capacity development of extension staffs 2-5 Support for maintenance and replacement of rice mills 2-6 Improvement of access to rice field
3. Support Program for Poor Rice Farmers (Extensive Rainfed)	- Poor rice farmers, who produce rice mainly for home consumption (estimated 19,000 households)	3-1 Field improvement for extensive rainfed rice farming 3-2 Improvement of extensive rain-fed rice farming 3-3 Production and distribution of quality rice seed 3-4 Farm tools improvement 3-5 Simple grain storage extension 3-6 Livelihood improvement

Selection of Priority Program and Areas for Action Plan

47. Taking into account the future projection of demand and supply, the "Stage-wise" development would be conceivable in the practical manner:

Stage-1: Short-Medium Term by 2012, effort to accelerate paddy production in 154,000 ha with average unit yield of 3.5 ton/ha (early attainment of production level of the present self-sufficiency level of 39% in 2015).

Stage-2: Long Term by 2015, effort to increase the self-sufficiency level toward to 65% as much as possible through further expansion of cultivation area and increase of unit yield, based on the progress of Stage-1.

Based on the above "Stage-wise Development", situation surrounding the programs proposed in the Master Plan is analyzed below:

Table 12 Integrated Development Program and its Situation

Integrated Development Programs	Situation, Direction and Priority
Market Driven Rice Enhancement Program (Type-1)	・ Irrigation rice farming produces 16% of total production to supply higher quality for urban demand. Large expansion of irrigation area requires to meet high growth of urban demand. ・ Present financial situation does not allow large expansion of irrigated area in the short term. Progress and performance of irrigation development are not enough for immediate expansion of area. ・ It is recommended to maintain the present trend for the time being. After some time, irrigation development would be reviewed for implementation of the "Stage-2" based on the economic and financial situation as well as the progress of rice production and demand.

Integrated Development Programs	Situation, Direction and Priority
Rain-fed Rice Promotion Program (Type-2)	・ Type-2 produces 80% of domestic rice, and many farmers are engaged in semi-intensive rice farming to supply to rural area and local urban areas. ・ Potential inland valley and lowland are extending over large area, but remain utilized. Staple production is expected through application of proper technology under supplemental irrigation, and the development cost is not so high as irrigation.
Support Program for Poor Rice Farmers (Type-3)	・ Upland rice is traditionally cultivated under marginal agro-ecological condition, and important, particularly in the three Savannas regions of Upper West, Upper East and Northern, where incidence of poverty is quite high. Low input rice like Nerica would be introduced for increase of home consumption and supplemental income.

Based on the above situation, the following two programs are selected for preparation of Action Plan:

- Rain-fed Rice Promotion Program — Type 2: Semi-intensive Rain-fed Rice Farming System in Inland Valleys and Lowland
- Support Program for Poor Rice Farmers — Type 3: Extensive Rain-fed Rice Farming System in Rain-fed Lowland and Upland

In terms of profitability in bringing income to farmers, rice is higher than other food crops like maize, yam, sorghum and plantain. However, profitability per unit acreage of rice, particularly Types 1 and 2, is not so high compared with vegetables and fruits for urban and export markets. Reduction of production cost is important but not limitation is there. In this case, it is necessary to create the circumstance to enable expansion of operation scale for formers.

In the long term, preference of food will be changing due to change in economic situation and fluctuation of price of foods, this will affect farmers income. In this situation, farmers will need enough capacity to change their farm management to suitable crops and commodities. It is expected through changing their farm management from traditional food crops to rice, farmers are able to obtain such capacity to adapt their management suitable for the economic situation. In promotion of domestic rice, management capacities will be reinforced for farmers, rice millers and traders.

“Rain-fed Rice Promotion Program” and “Support Program for Poor Rice Farmers” contains a wide variety of such components as rice production, processing, marketing livelihood improvement, as rural or regional development focusing on rice. In this case, smooth implementation may not be obtained in the virgin area where farmers and extension agents have no experiences in rice cultivation.

For the first step for implementation, methodology and approach will be established in the short term in the area where such relevant support agencies as research institutes and extension offices are available and accessible as well as similar projects are under implementation or implemented. Then, in the medium term, the methodology and approach will be extended to the other potential area. Therefore, the area for action plan to start the activities should have similar conditions with the other area to be extended. In this regard, the Ashanti and Northern regions are selected for short term activities, as shown below. *(9.4)*

Table 13 Selection of Area

Item	Ashanti	Northern
Relevant Research Institutes for Linkage	・Crop Research Institute ・Soil Research Institute	・Savanna Research Institute
Similar Projects and Programs for Rice	・Inland Valley Rice Development Project (AfDB) ・Nerica Rice Dissemination Project (AfDB) ・Sawah Pilot Project	・Lowland Rice Development Project (AFD) ・Nerica Rice Dissemination Project (AfDB)
Natural	・Rainforest and wet climate common to southern and central Ghana ・High potential of inland valley (more than 130 sites) ・Rural socio-economic situation common to southern and central Ghana	・Savanna ecological region common to northern Ghana ・High potential of Lowland (more than 70 sites) ・Rural socio-economic situation common to northern Ghana
Similarity with other area	・Kumasi is the largest market of domestic rice and rice flows from other regions. Other regions like the Western, Eastern, Central and Volta regions are similar marketing situation. ・Methodology and approach for production and marketing to be developed for Kumasi and surrounding markets and to be extended to other areas	・Largest production area to outflowing to other regions ・Climate condition of Savanna and high incidence of poverty common to Upper West and Upper East ・Methodology to approach to established in the Northern region and extend to the Upper West and Upper East regions
Other development project and programs focusing on agriculture and rural development	・Community Based Rural Development Project (WB)	・UNDP Rural Livelihood Project (UNDP) ・Intervention Zone 5 district under Millennium Challenge Account (MCA) located to improve trunk & feeder roads

Source: JICA Study Team

9. Action Plan

Approach to the Action Plan

48. In the preparation of the Action Plan for the Rain-fed Rice Promotion Program and Support Program for Poor Rice Farmers, the following points were considered; (1) selective application of development components depending upon the characteristics of each site, (2) consideration to preference of consumers based on quality, (3) improvement of price by ensuring quality and a shipping amount of products, (4) securing of sustainability to adopt rural development method, and (5) establishment of implementation method and application of it to other sites with similar conditions. The schematic diagram of this concepts is illustrated in the figure below: *(10.1)*

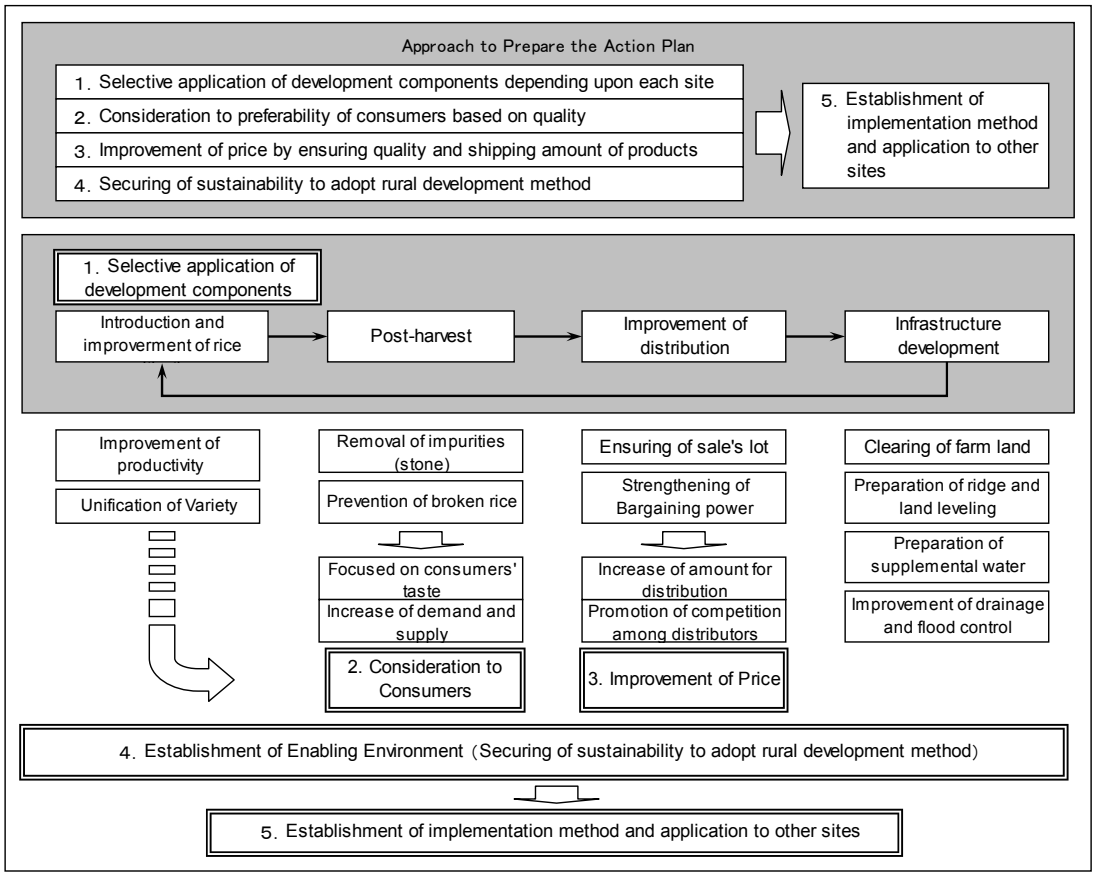


Figure 9 Conceptual Image of Action Plan (source: JICA Study Team)

Development Component of Priority Program

49. Taking the quality and shipment volume into account for marketing improvement, the following measures for quality improvement would be associated with the development component in the integrated development:

Table 14 Improvement Measures among Production to Marketing

	Farmers	Traders	Rice Millers
- Absence of impurities (Stone)	- Improvement in harvesting, threshing, drying and handling (tarpaulin sheet, pedal thresher, manual winnower, concrete floor, etc.)	- Handling, drying and processing of products at clean place - Selection of proper rice mill with better machinery components for milling their products	- Introduction of pre-cleaner and de-stoner - Replacement of Engelberg type to milling machine with rubber roll husker
- Uniformity	- Application of single variety seeds and improvement of farming practices	- Handling without mixture of different varieties	- Handling without mixture of different varieties
- Broken Rice	- Selection of proper harvesting time to avoid over-dry of grains - Improvement of farming & post-harvest practice.	- Selection of proper rice mill with better machinery components for milling their products	- Introduction of shifter & length grader - Replacement of Engelberg type to milling machine with rubber roll husker

	Farmers	Traders	Rice Millers
- Marketing	- Collection and shipment of uniform rice through group formation - Introduction of weighing equipment - Manifestation of Brand name and producers name	- Introduction of weighing equipment - Pricing of rice for both buying and selling according to quality (stone contents and uniformity)	- Introduction of weighing equipment - Application of different charge according to the quality of raw paddy

Source: JICA Study Team

Based on the above measures, new development components are elaborated in view of post-harvest and marketing, namely 1) Extension of improved post-harvest processing technologies, 2) Promotion of post-harvest processing equipment, 3) Rice mill modernization and 4) Support program for marketing activities. Details are shown below: *(10.1)*

Table 15 Development Components under Prioritized Program

Integrated Development Program	Development Component	
2. Rain-fed Rice Promotion Program (Type-2: Improvement of Semi-intensive Rain-fed Rice Farming System in Inland Valleys and Lowland)	2-1	Field improvement for semi-intensive rain-fed rice farming
	2-2	Improvement of semi-intensive rain-fed rice farming
	2-3	Community-based rice seed production and distribution
	2-4	Capacity development of extension staffs
	2-5	Improvement of access to rice field
	2-6	Extension of Improved Postharvest Processing Technology
	2-7	Promotion of Postharvest Processing Equipment
	2-8	Rice Mill Modernization
	2-9	Support for Marketing Activities
3. Support Program for Poor Rice Farmers (Type-3: Improvement of Extensive Rain-fed Rice Farming System in Rain-fed Lowland and Upland)	3-1	Field improvement for extensive rain-fed rice farming
	3-2	Improvement of extensive rain-fed rice farming
	3-3	Production and distribution of quality rice seed
	3-4	Farm tools improvement
	3-5	Simple grain storage extension
	3-6	Livelihood improvement
	3-7	Extension of Improved Postharvest Processing Technology
	3-8	Promotion of Postharvest Processing Equipment
	3-9	Rice Mill Modernization
	3-10	Support for Marketing Activities

Source：JICA study team

Field Visit at Sample Sites

50. Through selecting the sample sites for formulation of Action Plan, filed visits were carried out in the Ashanti and Northern regions during middle to late November 2007. The study team firstly visited the MOFA regional offices to explain the concepts, and consulted with the regional staff to select districts, as shown below:

Table 16 List of Districts selected for Sample Sites

Ashanti Region	Northern Region
Ahafo-Ano South (Mankranso)	Tolon-Kumbungu (Tolon)
Ejisu-Juaben (Ejisu)	Sevelugu-Nanton (Savelugu)
Ejura-Sekyedumanse (Ejura)	Karaga (Karaga)
Adansi South (Edubiase)	East Gonja (Salaga)

Note: () district capital, Source: JICA Study Team

At the selected districts, the study team consulted with the MOFA district staff for selection of sample sites and, 11 sites in the Ashanti region and 15 sites in the Northern region were selected. Filed visits were jointly carried out by the study team, extension agents and staff from the regional and district office. *(10.2)*

Identification of Rice Farming Type and Selection of Development Component

51. Sample sites were categorized into rice farming type particularly based on topographic condition, land consolidation condition, condition of water content in the field, water use facilities, farming practice method (planting, fertilizer and agrochemicals). In each type, current level of rice farming was investigated to judge direction of development. As a result, three steps in Type 2 and two steps in Type 3 were set. The following flow in the next page shows categorization of sample sites.

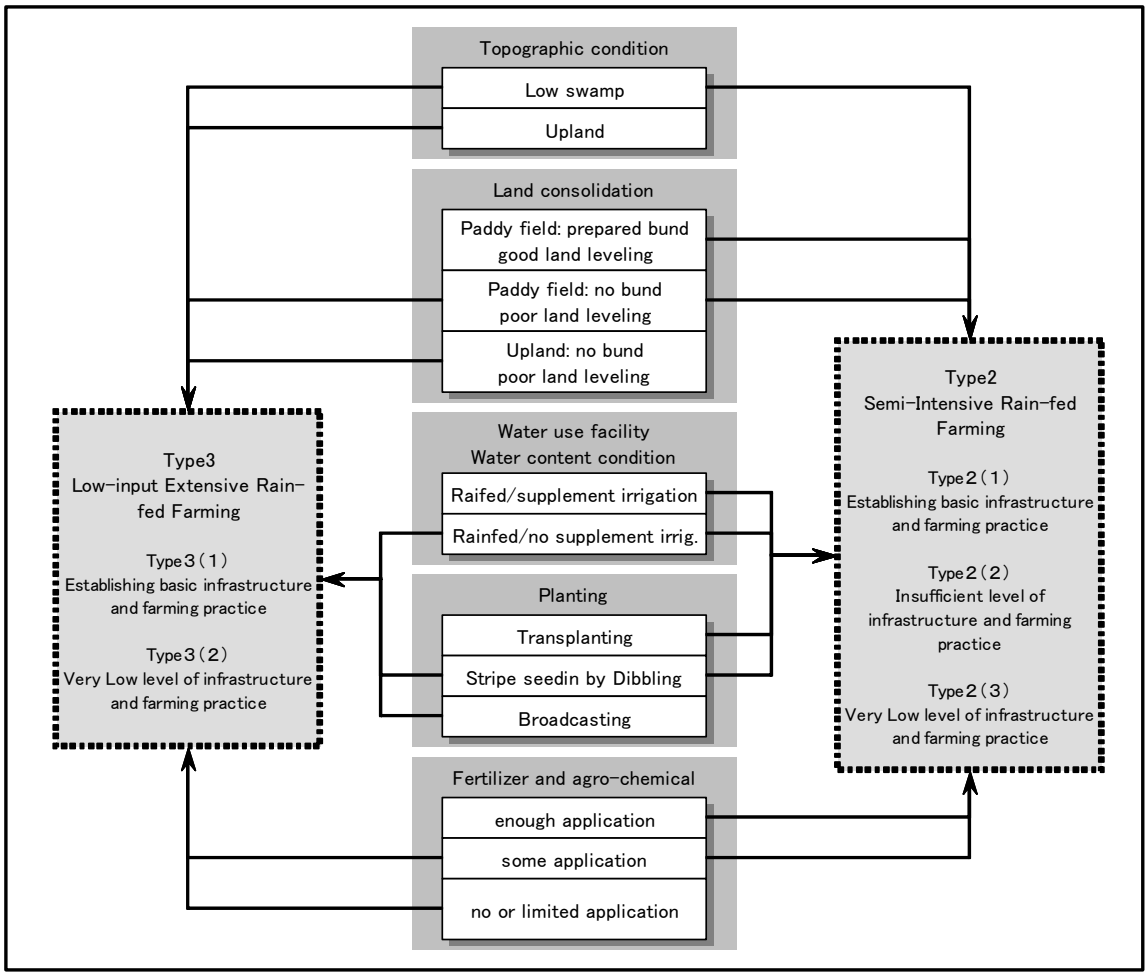


Figure 10 Flow of Categorization of Rice Farming Type in Sample Sites

Based on the above mentioned procedure, development components were selected and the detailed results are shown in the Attachment 10. Seven sites were categorized into Type 2, and four sites were into Type 3 in the Ashanti region. On the other hand, in the Northern region, five sites were categorized into Type 2 and eleven sites were into Type 3.

Development components were selected from the Integrated Development Programs for Type 2 and Type 3, considering the above mentioned current conditions. Especially in the sites where rice is being grown now, attentions were paid to the improvement of the following points; productivity (increase of unit yield), quality (removal of impurities such as stone), and sales side (increase of sales lot), and to the expansion of rice farming to surrounding areas. *(10.3)*

Implementation of Action Plan

52. In the Ashanti and Northern regions, 130 and 70 candidate sites were selected, and rice farming can be introduced in more sites than selected ones. The demand for rice is large mainly in urban areas and is considered to increase gradually in rural area. However, it is not easy to improve and introduce rice farming in many candidate sites at the same time. Step-wise development would be necessary. Namely, first, implementation method will be established, which reflects current level of rice farming at each site. And then rice farming will be expanded to surrounding areas by applying the established method with necessary modification.

In this sense, the following four steps are assumed as illustrated in Figure 10.3; 1) Planning and preparing for implementation, 2) Collecting site information, 3) Implementation in the site, and 4) Monitoring and evaluation. Progress of Action Plan will be monitored as needed, and feedback will be made to current implementation as well as next implementation in other sites.

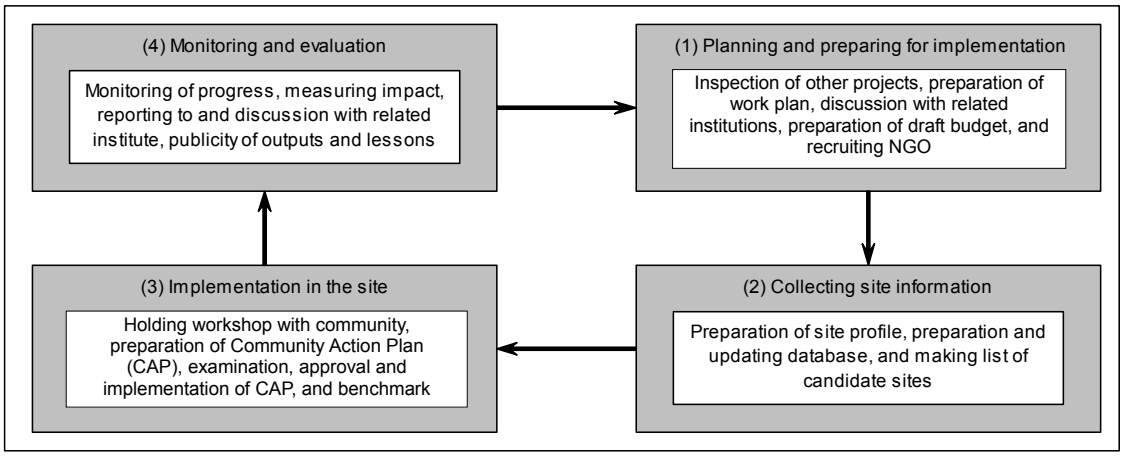


Figure 11 Implementation Cycle of Action Plan

(Source: JICA Study Team)

The above mentioned activities in the cycle of the Action Plan are shown as follows: *(10.4)*

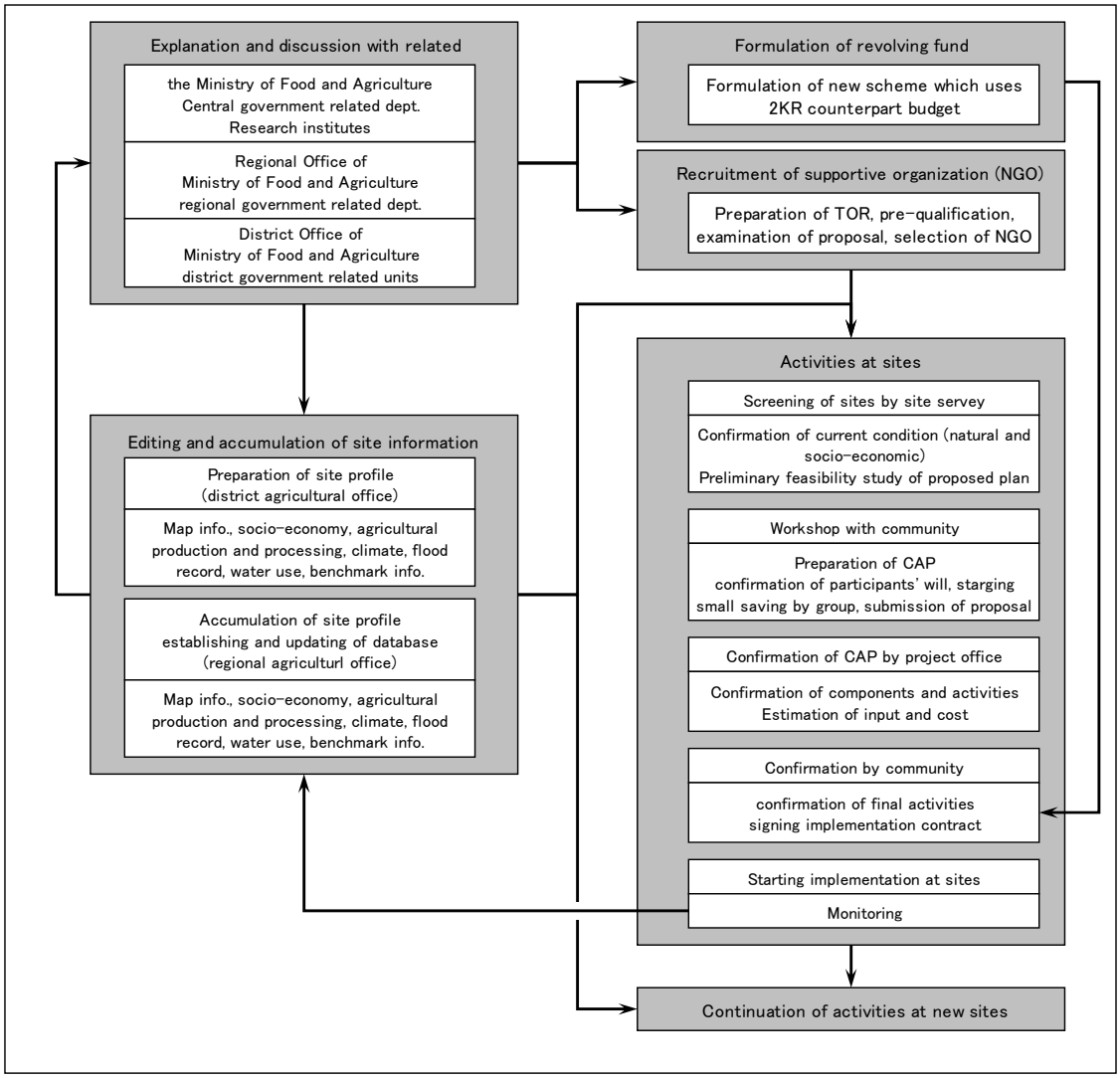


Figure 12 Flow of Particular Activities of the Action Plan

(Source: JICA Study Team)

The Study on
The Promotion of Domestic Rice in the Republic of Ghana

Final Report

Preface

Letter of Transmittal

Location Map

Ghana Administration Map

Summary

Table of Contents

		Page
Chapter 1	**Introduction**	1- 1
1.1	Background	1- 1
1.2	Objectives	1- 1
1.3	Study Area	1- 1
1.4	Study Schedule	1- 1
1.5	Counterpart and Steering Committee	1- 2
1.6	Study Activities in Phase 1	1- 2
1.7	Study Activities in Phase 2	1- 4
Chapter 2	**Socio-Economy and Development Plans of Ghana**	2- 1
2.1	Demography and Economy	2- 1
2.2	Land Holding and Tenure	2- 2
2.3	Government Development Policy	2- 5
Chapter 3	**Present Situation of Rice Production**	3- 1
3.1	Rice in Food Crop Production	3- 1
3.2	Regional Characteristics in Rice Production	3- 1
3.3	Planted Area and Average Yield of Rice	3- 4
3.4	Rain-fed Rice Development	3- 5
3.5	Irrigation Development for Rice Production	3- 7
3.6	Farm Management for Rice	3-10
3.7	Current Situation of Rice Farmers	3-14
3.8	Types of Rice Farming Systems and Financial Analysis	3-22
Chapter 4	**Post Harvest and Processing**	4- 1
4.1	Flow of Post Harvest of Rice in Ghana	4- 1
4.2	Reviews of the Present Situation of Post Harvest through the Baseline Survey	4- 5
4.3	Present Situation of Modern Rice Milling Plant	4-12
4.4	Direct Interview Survey for Small Scale Rice Millers	4-14
4.5	Futures of each Scale Rice Mills	4-14
4.6	Classification of Rice Processing Facilities	4-15
4.7	Issues to be considered in the Master Plan and Action Plan	4-18

Page

Chapter 5 Present Situation of Rice Marketing 5- 1
5.1 Rice Marketing Quantity 5- 1
5.2 Balance of Rice Supply and Demand 5- 1
5.3 Rice Distribution Channels and Quantity 5- 4
5.4 Rice Traders 5- 7
5.5 Consumer's Needs and Trend 5-11
5.6 Market Price and Cost and Margin Structure 5-16

Chapter 6 Supporting Systems for Agriculture 6- 1
6.1 Agricultural Research 6- 1
6.2 Agricultural Extension 6- 1
6.3 Agricultural Finance 6- 2
6.4 Production and Distribution of Certified Seeds 6- 3
6.5 Procurement and Distribution of Agricultural Inputs 6- 3
6.6 Related Organizations 6- 4
6.7 Support to the Rice Sector by GRIB 6- 7

Chapter 7 Problem Analysis 7- 1
7.1 Objectives 7- 1
7.2 Results of Workshop for Participatory Problem Analysis 7- 1
7.3 Structural Assessment on Development Constraints in Rice Sector of Ghana 7- 3
7.4 Problems in Paddy Production 7- 3
7.5 Problems in Post Harvest 7- 5
7.6 Problems in Rice Marketing 7- 9

Chapter 8 Results of Workshop on Study Progress 8- 1
8.1 Outline of the Workshop 8- 1
8.2 Regional Workshop in Kumasi 8- 1
8.3 District Workshop in Kumasi 8- 2
8.4 Regional Workshop in Tamale 8- 3
8.5 District Workshop in Tamale 8- 4

Chapter 9 Master Plan 9- 1
9.1 Objectives 9- 1
9.2 Basic Strategy for Mater Plan 9- 1
9.2.1 Basic Strategy 9- 1
9.2.2 Basic Consideration for Formulation of Master Plan 9- 4
9.3 Rice Demand Projection in 2015 ..... 9- 6
9.3.1 Rice Consumption Trend 9- 6
9.3.2 Rice Demand Projection 9- 7
9.4 Integrated Development Programs and Components 9-11
9.5 Marketing Driven Rice Enhancement Program 9-12
9.5.1 Rehabilitation and Expansion of Existing Irrigation Schemes (Component:1-1) 9-12
9.5.2 Participatory Irrigation Development (Component:1-2) 9-14
9.5.3 Improvement and Extension of Appropriative Farm Mechanization Work (Component:1-3) 9-14
9.5.4 Production Cost Saving of Paddy (Component:1-4) 9-15
9.5.5 Production and Distribution of Quality Rice Seeds (Component:1-5) 9-16
9.5.6 Quality Improvement of Milled Rice (Component:1-6) 9-17

Page

9.5.7 Improvement of Rice Marketing Information Network (Component:1-7) 9-18
9.5.8 Enlargement of Domestic Rice Consumption and Marketing (Component:1-8) 9-19
9.6 Rain-fed Rice Promotion Program (Semi-Intensive Rain-fed) 9-20
9.6.1 Field Improvement for Semi-intensive Rain-fed Rice Farming (Component 2-1) 9-20
9.6.2 Improvement of Semi-Intensive Rain-fed Rice Farming (Component 2-2) 9-22
9.6.3 Community-Based Rice Seed Production and Distribution (Component:2-3) 9-23
9.6.4 Capacity Development of Extension Staff (Component 2-4) 9-24
9.6.5 Support for Maintenance and Replacement of Rice Mills (Component 2-5).... 9-24
9.6.6 Improvement of Access to Rice Field (Component 2-6)..... 9-24
9.7 Support Program for Poor Rice Farmers (Extensive Rain-fed) 9-25
9.7.1 Field Improvement for Extensive Rain-fed Rice Farming (Component 3-1) ... 9-25
9.7.2 Improvement of Extensive Rain-fed Rice Farming (Component 3-2)..... 9-25
9.7.3 Production and Distribution of Quality Rice Seed (Component 3-3) 9-26
9.7.4 Farm Tools Improvement (Component 3-4) 9-27
9.7.5 Simple Grain Storage Extension (Component 3-5)..... 9-27
9.7.6 Livelihood Improvement (Component 3-6) 9-29
9.8 Priority of Integrated Development Program..... and Selection of Area for Action Plan..... 9-30
9.8.1 Priority of Integrated Development Program..... 9-30
9.8.2 Selection of Area for Action Plan..... 9-33
9.8.3 Approach to Action Plan 9-34

Chapter 10 Action Plan..... 10- 1
10.1 Approach to Prepare the Action Plan 10- 1
10.2 Field Visits at Sample Sites..... 10- 7
10.3 Grouping of Sample Sites and Selection of Development Components 10-10
10.4 Implementation of Action Plan 10-14

Chapter 11 Technology Transfer Program..... 11- 1
11.1 Technology Transfer in Phase -1 Study..... 11- 1
11.2 Technology Transfer Programs in Phase-2 Study 11- 2

Chapter 12 Environmental and Social Consideration 12- 1
12.1 Law and System Related to Environment..... 12- 1
12.1.1 Organization Related to Environment..... 12- 1
12.1.2 List of Law and Regulation Related to Environment..... 12- 2
12.2 Initial Environmental Study for the Master Plan 12- 3
12.2.1 Environmental and Social Condition 12- 3
12.2.2 Results of Evaluation 12- 4
12.3 Initial Environmental Study for the Action Plan..... 12- 6
12.3.1 Environmental and Social Condition in the Target Area of the Action Plan..... 12- 6
12.3.2 Results of Evaluation about the Action Plan..... 12- 7

List of Tables

		Page
Table 2.1	Macro Economic Indicators of Ghana	2- 1
Table 2.2	Total and Agricultural Imports	2- 2
Table 2.3	Community Land Management by Region	2- 2
Table 2.4	Rice Related Projects and Programs	2- 9
Table 2.5	Budget of Ministry of Food and Agriculture	2- 9
Table 2.6	Components of Millennium Challenge Account	2-10
Table 2.7	Categories / Sectors of Irrigation under the Policy	2-11
Table 3.1	Food Crop Production of Ghana (1996 - 2005)	3- 1
Table 3.2	Categorization of Paddy Field in Ghana	3- 5
Table 3.3	Rice Production Program 2005-2010	3- 7
Table 3.4	Salient Features of 22 Irrigation Schemes	3- 7
Table 3.5	Planted Area, Paddy Production and Yield of the GIDA Schemes	3- 8
Table 3.6	Rice Varieties in Ghana	3-10
Table 3.7	Outline of Baseline Survey Sites	3-14
Table 3.8	Farmers' Family Size by Region	3-15
Table 3.9	Current Situation on Land Holding and Cultivated Farm Land by Region	3-17
Table 3.10	Current Condition on Cultivation of Paddy and Upland Crops	3-17
Table 3.11	Cultivated Varieties in Each Region	3-19
Table 3.12	Unit Yield of Paddy	3-20
Table 3.13	Constraints on Paddy Cultivation	3-21
Table 3.14	Typical Farm Economy	3-22
Table 3.15	Typical Rice Farming Systems of Ghana	3-23
Table 3.16	Grouping on Sites of Baseline Survey	3-25
Table 3.17	Cost-Benefit Analysis of Type 1 for Irrigated Rice	3-25
Table 3.18	Cost-Benefit Analysis of Types 2 and 3 for Rain-fed Rice	3-27
Table 4.1	Comparison of Number of Farm Machinery between 1980s and 2002	4- 1
Table 4.2	Details of the Studied Area by the Baseline Survey	4- 5
Table 4.3	Present Situation of Harvesting Work	4- 6
Table 4.4	Present Situation of Threshing Work	4- 6
Table 4.5	Present Situation of Drying Work	4- 7
Table 4.6	Present Situation of Paddy Storage by Farmers (Sep. - Oct., 2006)	4- 7
Table 4.7	Present Situation of Rice Milling	4- 8
Table 4.8	Milling Charge of Small Rice Millers (Sep. - Oct., 2006)	4- 8
Table 4.9	Analysis Result of Milled Rice purchased in the Local Market	4- 9
Table 4.10	Grade Distribution of Domestic and Imported Rice	4-10
Table 4.11	Length Distribution of Domestic and Imported Rice	4-10
Table 4.12	Relation between Length of Milled Rice and Retail Price	4-11
Table 4.13	Grade of Milled Rice by Ghana Standard Board (Extracts)	4-11
Table 4.14	Summary of Direct Interview Survey for Irrigation Projects and Modern Rice Mills	4-12
Table 4.15	Summary of Direct Interview Survey for Small Scale Rice Millers	4-14
Table 4.16	Comparison of Rice Milling Charges	4-15
Table 5.1	Rice Distribution Quantities (2000 - 2003)	5- 1
Table 5.2	Rice Balance Sheet in Ghana	5- 2
Table 5.3	Frequency of Rice Consumption per Week for Urban Consumers and Estimation of Average Per-capita Consumption	5- 2
Table 5.4	Estimation of Rice Per-capita Consumption of Rural Population	5- 3

		Page
Table 5.5	Estimated Rice Consumption by Urban and Rural in Each Region (2003)	5- 3
Table 5.6	Estimated Rice Balance by Each Region (2003)	5- 4
Table 5.7	Assumption of Distribution Quantity by Region	5- 6
Table 5.8	General Condition of Interviewees	5-11
Table 5.9	Factors Considered for Choice of Rice	5-12
Table 5.10	Consumption Frequency per Week for Major Foods	5-13
Table 5.11	List of Samples used for EGM Survey	5-14
Table 5.12	Breakdown Cost of Rice Import	5-16
Table 5.13	Imported Rice Cost Estimation	5-17
Table 5.14	Costs and Margin of Imported Rice	5-17
Table 5.15	Sales Price of Rice Producers	5-19
Table 5.16	Farm Gate Price of Rice	5-19
Table 5.17	Sales Price of Producers and Wholesale Price in 5 Regions	5-20
Table 5.18	Cost and Margin Structure on Local Rice Distribution	5-21
Table 5.19	Commodities List for Market Data Collection	5-23
Table 5.20	Markets List for Market Data Collection	5-23
Table 6.1	Regional Agricultural Extension Agents (AEA)	6- 1
Table 6.2	Education and Training Institutes for Agricultural Extension	6- 2
Table 6.3	Terms and Conditions of Agricultural Development Bank	6- 3
Table 6.4	Seed Production and Maintenance	6- 3
Table 6.5	Coverage Area of GRIB	6- 8
Table 7.1	Outline of Workshop	7- 1
Table 7.2	Comparison of Number of Farm Machinery between 1980s and 2002	7- 5
Table 7.3	Result of Analysis of Domestic and Imported Rice	7- 6
Table 7.4	Result of Classification of Domestic and Imported Rice by Milled Rice Quality Standard	7- 6
Table 7.5	Cause-Effect Analysis of Lower Quality Rice (Management)	7- 7
Table 7.6	Cause-Effect Analysis of Lower Quality Rice (Technical Issues)	7-10
Table 7.7	Problem Analysis of Rice Distribution and Marketing	7-11
Table 8.1	Four Sessions of Workshop	8- 1
Table 9.1	Basic Indicators and Rice Demand Projection	9- 8
Table 9.2	Rice Demand Projection in Urban and Rural Areas	9- 8
Table 9.3	Future Supply - Demand and Requirement of Rice Development	9- 9
Table 9.4	Integrated Development Programme and Development Components	9-11
Table 9.5	Rehabilitation of Nine Irrigation Schemes	9-12
Table 9.6	Rehabilitation and Expansion of the Existing Irrigation Projects	9-13
Table 9.7	Participatory Irrigation Development	9-14
Table 9.8	Optimization and Dissemination of Mechanized Farming Practices	9-15
Table 9.9	Production Cost Saving of Paddy	9-16
Table 9.10	Production and Distribution of Quality Rice Seeds	9-17
Table 9.11	Quality Improvement of Milled Rice	9-18
Table 9.12	Improvement of Rice Marketing Information	9-18
Table 9.13	Enlargement of Domestic Rice Consumption and Marketing	9-20
Table 9.14	Field Improvement for Semi-intensive Rain-fed Rice Farming	9-22
Table 9.15	Improvement of Semi-Intensive Rain-fed Rice Farming	9-23
Table 9.16	Community-based Rice Seed Production and Distribution	9-23
Table 9.17	Capacity Development of Extension Staffs	9-24
Table 9.18	Support for Maintenance and Replacement of Rice Mills	9-24

		Page
Table 9.19	Improvement of Access to Rice Field	9-25
Table 9.20	Field Improvement for Extensive Rain-fed Rice Farming	9-25
Table 9.21	Improvement of Extensive Rain-fed Rice Farming	9-26
Table 9.22	Result of NERICA Variety Test in SSIAP(dry season in 2001)	9-26
Table 9.23	Production and Distribution of Quality Rice Seed	9-27
Table 9.24	Improvement of Farm Tools	9-27
Table 9.25	Simple Grain Storage Extension	9-29
Table 9.26	Livelihood Improvement	9-29
Table 9.27	Increment of Rice Demand in Urban and Rural Area	9-30
Table 9.28	Long List of New Irrigation Schemes under GIDA	9-31
Table 9.29	Selection of Area	9-33
Table 10.1	Development Component under the Prioritized Program	10- 2
Table 10.2	Factor for Rice Choice	10- 2
Table 10.3	Sales Price at Producers	10- 3
Table 10.4	Improvement Measures among Production to Marketing	10- 3
Table 10.5	Development Component Newly Proposed in the Action Plan	10- 4
Table 10.6	Extension of Improved Postharvest Processing Technology Program	10- 4
Table 10.7	Promotion of Postharvest Processing Equipment Program	10- 4
Table 10.8	Rice Mill Modernization Program	10- 5
Table 10.9	Support Program for Marketing Activities	10- 5
Table 10.10	Development Components under Prioritized Program	10- 6
Table 10.11	List of Districts selected for Sample Sites	10- 7
Table 10.12	Brief Feature of Sample Sites (Ashanti Region)	10- 8
Table 10.13	Brief Feature of Sample Sites (Northern Region)	10- 9
Table 10.14	Checklist for Rice Farming Type	10-10
Table 10.15	Category Groups of Sample Sites	10-12
Table 10.16	Development Component for Sample Sites for Type 2	10-13
Table 10.17	Development Component for Sample Sites for Type 3	10-14
Table 10.18	Activities of Implementation Cycle of Action Plan	10-15
Table 11.1	Progress of Technology Transfer Programs	11- 3
Table 12.1	List of Environmental Related Regulation	12- 3
Table 12.2	Items to be Considered for Environmental and Social Consideration	12- 4
Table 12.3	Expected Items and Mitigation Measures Related to Development Components	12- 5
Table 12.4	Socio-economic Conditions in the Ashanti region and the Northern region	12- 6
Table 12.5	Items which likely to have Impacts on Aspects of Environmental and Social Consideration in the Action Plan	12- 7

List of Figures

		Page
Figure 2.1	Intervention Zones of MCA	2-10
Figure 2.2	Steps for National Irrigation Policy	2-11
Figure 3.1	Past Trend of Cereal Production (1996-2005)	3- 1
Figure 3.2	Length of Growing Period Zones	3- 2
Figure 3.3	Per Capita Crop Production by District	3- 2
Figure 3.4	Per Capita Paddy Production (2003)	3- 3
Figure 3.5	Per Capita Rice Production by District (2000)	3- 3

		Page
Figure 3.6	Paddy Production in Ghana (1996-2005)	3- 4
Figure 3.7	Annual Paddy Production by Region	3- 4
Figure 3.8	Relationship between Paddy Production and Yield (1996-2005)	3- 5
Figure 3.9	Relationship between Paddy Production and Planted Area (1996-2005)	3- 5
Figure 3.10	Cropping Patterns of Rain-fed Rice	3-11
Figure 3.11	Mean Monthly Rainfall at Major Locations	3-12
Figure 3.12	Locations for Baseline Survey	3-16
Figure 3.13	Typical Cropping Pattern	3-19
Figure 4.1	Grade Distribution of Domestic and Imported Rice	4-10
Figure 4.2	Relation between Grade and Retail Price of Milled Rice	4-11
Figure 4.3	Relation between Broken Rice Ratio and Retail Price of Milled Rice	4-11
Figure 4.4	Flow Chart of Rice Post Harvest in Ghana	4-17
Figure 5.1	Rice Production and Import (paddy equivalent)	5- 1
Figure 5.2	Major Rice Distribution Channels and Quantity in Ghana	5- 7
Figure 5.3	Various Distribution Channels for Imported Rice	5- 7
Figure 5.4	Distribution Condition of Local Rice (1)	5- 9
Figure 5.5	Distribution Condition of Local Rice (2)	5- 9
Figure 5.6	Distribution Condition of Local Rice (3)	5-10
Figure 5.7	Preference on Kind of Rice	5-12
Figure 5.8	Retail Price of Imported Rice	5-17
Figure 5.9	Retail Price of Imported Rice on 7 Brands	5-18
Figure 5.10	Average Wholesale Price of Imported Rice in 2005	5-18
Figure 5.11	Comparison of Monthly Retail Price between Imported Rice and Local Rice	5-22
Figure 6.1	Organization Chart of Ministry of Food and Agriculture	6- 4
Figure 6.2	Organization Chart of Regional and District Government	6- 5
Figure 6.3	Organization Chart of Regional Office of Ministry of Food and Agriculture (Northern Region)	6- 6
Figure 6.4	Organization Chart of District Office of Ministry of Food and Agriculture (Zabzugu district and Tamale municipality in Northern Region)	6- 6
Figure 6.5	Project Office of Inland Valley Rice Development Project	6- 7
Figure 7.1	Structural Problems in Rain-fed Rice Development	7- 4
Figure 7.2	Relationship between Grain Moisture Content when Harvested and Whole Grain Recover Rate	7- 5
Figure 7.3	Structural Problems in Rice Distribution and Marketing	7-12
Figure 9.1	Generalized Rice Distribution Flows from Producers to Consumers	9- 2
Figure 9.2	Rice Import by African Countries	9- 6
Figure 9.3	Rice Import by Ghana	9- 6
Figure 9.4	Per capita Consumption of Cereals in Ghana	9- 7
Figure 9.5	Per capita Consumption of Starchy Root and Plantain in Ghana	9- 7
Figure 9.6	Rice Demand Projection	9- 8
Figure 9.7	Generalized Type-wise Concept from Production to Consumption	9-10
Figure 9.8	Excessive Growth of Weeds under shallow water in Poor Leveling	9-21
Figure 9.9	Proposed Small Scale Grain Store	9-28
Figure 9.10	Present Demand and Supply of Rice	9-29
Figure 9.11	Future Demand and Supply of Rice	9-30
Figure 9.12	Potential Sites in Ashanti Region	9-34
Figure 9.13	Potential Sites in Northern Region	9-34
Figure 10.1	Concept of Action Plan	10- 1

Page

Figure 10.2 Flow of Categorization of Rice Farming Type in Sample Sites 10-11
Figure 10.3 Implementation Cycle of Action Plan 10-15
Figure 10.4 Flow of Particular Activities of the Action Plan..... 10-17
Figure 12.1 Organization Chart of Environmental Protection Agency..... 12- 1
Figure 12.2 Necessary Steps of Environmental Impact Assessment 12- 2

List of Attachments

Attachment-1 (1) Scope of Work (SW) and Minutes of Meeting on SW for the Study
Attachment-1 (2) Minutes of Meeting on Inception Report
Attachment-1 (3) Minutes of Meeting on Progress Report (1)
Attachment-1 (4) Minutes of Meeting on Interim Report
Attachment-1 (5) Minutes of Meeting on Progress Report (2)
Attachment-1 (6) Minutes of Meeting on Draft Final Report
Attachment-1 (7) Brochure on the Study
Attachment-3 (1) Crop Production Records in Ghana
Attachment-3 (2) History of NERICA Dissemination in Ghana
Attachment-9 (1) List of Potential Area for Rice Development in Ashanti Region
Attachment-9 (2) List of Potential Area for Lowland Rice Development in Northern Region
Attachment-10 (1) Development Components Newly Added to the Action Plan
Attachment-10 (2) Rice Farming Type of Each Sample Site and Development Component
Attachment-10 (3) Rice Farming Tools and Machinery
Attachment-12 Ranking by Environmental Impact Assessment of the Study
(Rank・Reason・Countermeasure)

List of Acronyms

AAGDS	Accelerated Agricultural Growth and Development Strategy
ADB	Agricultural Development Bank
AEA	Agricultural Extension Agent
AESD	Agricultural Engineering Services Directorate
AEZ	Agro-Ecological Zone
AFD	French Development Agency
AfDB	African Development Bank
AIP	Afife Irrigation Project
A/P	Action Plan(s)
AgSSIP	Agricultural Services Sub-sector Investment Programme
BOG	Bank of Ghana
CBO	Community Based Organization
CCTC	Continental Commodities Trading Co (Gh) Ltd
CEPS	Custom Excise and Preventive Service
CIDA	Canadian International Development Agency
COCOBOD	Ghana Cocoa Board
CRI	Crops Research Institute
CSD	Crop Services Directorate
CSIR	Council for Scientific and Industrial Research
CU	Co-operative Union
DAES	Directorate of Agricultural Extension Services
DANIDA	Danish International Development Agency
DAO	District Agricultural Office
DfID	Department for International Development
DIP	Dawhenya Irrigation Project
ECOWAS	Economic Community of West African States
EDIF	Export Development and Investment Fund
EGM	Evaluation Grid Method
FAO	Food and Agriculture Organization
FAPIM	Farmers' Participation in Irrigation Management
FASDEP	Food and Agriculture Sector Development Policy
FBO	Farmer Based Organization
FIC	Farm Input Credit
FSRPOP	Food Security and Rice Producers Organization Project
GERM	Ghana Environmental Resources Management Project
GDP	Gross Domestic Product
GIDA	Ghana Irrigation Development Authority
GNI	Gross National Income
GOG	Government of Ghana
GPRS	Ghana Poverty Reduction Strategy
GRIB	Ghana Rice Inter-Professional Body
GSB	Ghana Standard Board

GSFP	Ghana School Feeding Programme
GSS	Ghana Statistical Services
GTZ	German Agency for Technical Co-operation
HIPC	Heavy Indebted Poor Country
HIV/AIDS	Human Immunodeficiency Virus, Acquired Immune Deficiency Syndrome
ICOUR	Irrigation Company of Upper Region
IDC	Irrigation Development Centre (GIDA)
IFAD	International Fund for Agricultural development
IMEXCO	Imexco Ghana Limited
IMF	International Monetary Fund
IPM	Integrated Pest Management
ISC	Irrigation Service Charge
ITFC	Integrated Tamale Fruit Company, large scale mango farm in Northern Region
IVRDP	Inland Valley Rice Development Project
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
LACROSREP	Land Consolidation and Rehabilitation Project
LRDP	Lowland Rice Development Project
MAG	Marketing Activities Group
MCA	Millennium Challenge Account
MCC	Millennium Challenge Company
MDGs	Millennium Development Goals
MEST	Ministry of Environment, Scientific and Industrial Technology
M&E	Monitoring and Evaluation
M/M	Minutes of Meeting
M/P	Master Plan[s]
MISTOWA	Market Information Systems and Traders Organization in West Africa
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
MOTI	Ministry of Trade and Industry
MOU	Minutes of Understanding
MTADP	Medium-Term Agricultural Development Programme
NAEP	National Agricultural Extension Programme
NEPAD	New Partnership for African Development
NERICA	New Rice for Africa
NGO	Non-Governmental Organization
NHIL	National Health Insurance Levy
NPK	Nitrogen, Phosphate and Potassium (fertilizer components)
NRDP	Nerica Rice Dissemination Project
NRDP	Nerica Rice Dissemination Project
OLAM	Olam Ghana Ltd.
O&M	Operation and Maintenance
RADU	Regional Agricultural Development Unit
RAO	Regional Agricultural Officer

SARI	Savanna Agricultural Research Institute
SMS	Subject Matter Specialist
SPFS	Special Program for Food Security under FAO
SRI	Soil Research Institute
SRID	Statistics, Research and Information Directorate
SSIAPP	Small-Scale Irrigated Agriculture Promotion Project
S/W	Scope of Work
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USDA/FAS	United States Department of Agriculture/Foreign Agricultural Services
UWADEP	Upper West Agricultural Development Project
VAT	Value Added Tax
VIP	Village Infrastructure Project
WAO	Workshop for Action Plan Orientation under SSIAPP
WARDA	West Africa Rice Development Association [Africa Rice Center]
WIAD	Women in Agricultural Development
WB	World Bank

Units and Currency

ac	acre
kg	kilogram
t	ton
qt	quintal (100 kilogram)
h	hour
mm	millimeter
cm	centimeter
m	meter
km	kilometer
ha	hectare
km^2	square kilometer
m^3	cubic meter
MCM	million cubic meter
mm/mon	millimeter per month
mm/d	millimeter per day
m/s	meter per second
m^3/s	cubic meter per second
° C	degrees centigrade
%	percent
US$	United States of America Dollar
¢	cedi (old currency)
GH¢	Ghana cedi (new currency)

Exchange Rate

US$1.00 = ¥106.18= ¢10,618 (GH¢ 1.0618)

¢1.00 = ¥0.010

(GH¢ = ¥108.837)

(March, 2008)

Bank of Ghana implemented the Re-Denomination of the currency on July 1st 2007
to convert old currency (cedi: ¢) to new currency (Ghana cedi: GH¢)
at the rate of 1:10,000.

CHAPTER 1 INTRODUCTION

1.1 Background

Rice is the second most important cereal next to maize in Ghana. In recent years, its consumption has sharply increased, and the total rice consumption of Ghana in 2003 amounted to about 500,000 ton, equivalent to an annual consumption of 22 kg per capita. The rice market of Ghana depends largely upon imported rice to make up for a deficit in rice supply. The self-sufficiency ratio of rice in Ghana is as low as 20% to 30%. In view of food security and foreign currency saving, increased production of domestic rice with higher competitiveness against imported rice is the most urgent issue in the agricultural sector of Ghana.

In this situation, the Government of Ghana requested to the Government of Japan to extend technical cooperation in order to carry out the master plan study for the rice sector of Ghana (hereinafter referred to the Study), in which an integrated approach is to be undertaken to rationalize activities in rice production, processing, distribution and marketing. In response to this request, the Government of Japan sent a preliminary study mission to Ghana. Both governments discussed and concluded the scope of work (S/W) and the minutes of the meeting (M/M) on 30th June 2005 (Refer to Attachment-1(1)).

The Study was carried out for 22 months from June 2006 to March 2008, and this Final Report describes the Master Plan to promote domestic rice production and its Action Plan along with the study result worked out in the course of the Study.

1.2 Objectives

The Study is carried out with the following objectives;

- Preparation of a Master Plan (M/P) and an Action Plan (A/P) in order to promote domestic rice production in Ghana, and
- Transfer of knowledge and technologies to the counterpart personnel of the Ministry of Food and Agriculture of Ghana through the Study.

1.3 Study Area

The Study covers the entire nation in preparation of the M/P and the priority areas to be selected for the A/P.

1.4 Study Schedule

The Study consists of the following two phases to be carried out, and the Study period was originally planned for 22 months until March 2008. Since the counterpart agency requested early completion of the Study to establish project implementation organization in the Phase 1 Study, the Study would be completed by the end of March 2008, as shown below.

- Phase-1 : Preparation of the M/P in 10 months from June 2006 to March 2007
- Phase-2 : Preparation of A/P in 12 months from April 2007 to March 2008

1.5 Counterpart and Steering Committee

The counterpart agency is the Crop Service Directorate of Ministry of Food and Agriculture (MOFA). The Steering Committee was organized by MOFA to ensure smooth implementation of the Study, by nominating members consisting of the Ministry of Finance and Economic Development, Ghana Irrigation Development Authority (GIDA), Council for Scientific and Industrial Research (CSIR), and the JICA Ghana Office.

1.6 Study Activities in Phase 1

Phase 1 was carried out for nine months during the period from July 2006 to March 2007, and the results are described as follows:

(1) Explanation and Discussion on Inception Report

The JICA Study Team (the team) presented the Inception Report to MOFA on July 12th, 2006, and survey items and method were agreed by the MOFA, then the Plan of Operation was understood basically. The undertakings of MOFA and assignment of counterpart personnel agreed in the scope of work for the Study were also confirmed, respectively. Minutes of Meeting on the Inception Report are shown in Attachment-1 (2).

(2) Exchange of Views with Donor Agencies

The team is going to visit the donor agencies, explain the objectives and plan of operation of the Study, and exchange views about domestic rice development in Ghana, in order to affect their experience and lessons. The team had discussions with the French Development Agency (implementing the Food Security and Rice Producers Organization Project) and the African Development Bank (AfDB)

(3) Confirmation of Policy Plans

The fundamental plans such as, Ghana Poverty Reduction Strategies-I and II (GPRS-I and II), Food and Agriculture Sector Development Policy, 2001, and Accelerated Agricultural Growth and Development Strategies, have been studied to clarify the developmental direction of the domestic rice sector.

(4) Preparation of Brochure on the Study

The brochure has been distributed to the organizations concerned for publicity and promotion of the Study (Refer to Attachment -1(7)).

(5) Collection and Analyses of Existing Data and Information

Data on the current conditions for paddy production, post-harvest activities, and rice marketing has been collected, and thus the constraints on these have been analyzed.

(6) Baseline Survey and Analyses on Rice Production and Post-harvest Activities

A baseline survey and analyses on rice production and post-harvest activities were carried out at three (3) sites in each of five regions of Western, Volta, Ashanti, Northern, and Upper West, involving the application of an interview survey with a questionnaire under the sub-contract. Socio-economy, agricultural production, and post-harvest were assessed and their attendant problems were analyzed.

(7) Baseline Survey and Analyses on Rice Marketing System

1) Clarification of features of the rice marketing system based on the existing data and information

Based on this data and information, general features of the rice marketing system were studied. The scope and developmental framework for rice marketing were confirmed from the viewpoints of developmental plans, economic policies, and national food security.

2) Rice distribution survey (Sub-contract survey)

Interview surveys covering local traders (paddy and rice), wholesalers, and retailers were conducted, aimed at collection of quantitative data.

3) Rice marketing survey (Sub-contract survey) of rice distribution survey)

This survey was carried out to clarify consumer needs and preferences as well as rice quality requirements based on consumer needs. An interview survey adopted by the EGM (Evaluation Grid Method) was also executed.

4) Rice quality analysis (Sub-contract survey) of rice distribution survey)

Around 100 rice samples from retailers in 3 provinces out of 5 provinces selected for the baseline survey as well as Accra were taken, and analyzed based on the evaluation criteria for rice quality authorized by Ghana Standard Board (GSB).

(8) Analyses on Development Constraints and Potentials for Promotion of Domestic Rice

Based on the existing data, balance of rice demand and supply was studied. Demand and supply projections shall be a macro framework for the Master Plan, thus development potentials in the fields of production, processing, and marketing were analyzed.

(9) Preparation of Progress Report (1)

Based on the results of field work up to November 2006, a Progress report (1) was prepared and explained to MOFA. The contents of the Report were confirmed and agreed as shown in Attachment-1(3).

(10) Workshop for Participatory Problem Analyses and Supplementary Survey

In order to clarify constraints in the rice sector and identify the improvement direction, workshops were made inviting government staff, rice millers, traders, consumers and farmers, in Accra, Tamale

(the Northern region), and Ho & Hohoe (the Volta region). Parallel with the workshops, a supplemental survey was made for additional data collection and confirmation of development constraints.

(11) Prioritization of Targets and Preparation of Draft Master Plan (MP)

Based on the Study results mentioned above, development subjects in rice sector of Ghana were identified and prioritized according to their requirements and effects. And a Draft master plan and components were prepared.

(12) Preparation of Technology Transfer Program

It is confirmed that participation of regional MOFA staff in the Study in Phase-1 Study, and participation of central counterparts in MOFA was requested for future implementation of the projects in the MP.

(13) Preparation and Finalization of Interim Report

A Draft Interim Report was prepared in Japan based on the Study results of the 1st Phase, and presented to the Advisory Committee, then finalized according to the comments and advice made.

1.7 Study Activities in Phase 2

(1) Explanation and Discussion on Interim Report

The team presented the Interim Report to the Steering Committee on May 22nd 2007, and attached priority to promotion of lowland rice farming and the in-depth study on inland valley development, since those two types of farming produce nearly 80% of the total domestic rice, covering the majority of rice farmers. Minutes of the Meeting on the Interim Report is shown in Attachment-1 (4).

(2) Regional workshops at Tamale and Kumashi

The regional and district workshops were held in Kumasi for the central and southern area on August 27th to 28th and Tamale for the northern area in August 30th to 31st, 2007, under sub-contract to the local consulting firm. In the workshops, the integrated development programs in the draft master plan were explained, and the program components were discussed by the representatives of regions and districts. A general understanding was obtained from the participants on the importance of the rain-fed rice promotion program and support program for poor rice farmers.

(3) Study on Development Components in MP (Draft) and Detailed Survey

An additional survey was conducted for revision of the draft master plan and preparation of the action plan, covering the items of inland valley development, farming practice, post harvest, price information, research activities, land management, farmers' organization, etc.

(4) Preparation of Progress Report (2)

The Progress Report (2) was prepared based on the Study results up to the end of October 2007, and presented to the Steering Committee on November 11th, 2007. Minutes of the Meeting on the

Progress Report (2) is shown in Attachment-1 (5).

(5) Field Survey for Preparation of Action Plan

Field visits for the action plan were made at 11 sites in 4 districts in the Ashanti region and 15 sites of 4 districts in the Northern region .

(6) Workshop for Action Plan

Workshops for Action Plan were held in Tamale for the Northern region on December 11 and in Accra for the the Ashanti region on December 14th, 2008.

(7) Preparation of Draft Final Report

The team prepared the Draft Final Report based on the Study results up to late December 2007, and presented to the Steering Committee on December 18th, 2007. Minutes of the Meeting on the Draft Final Report are shown in Attachment-1 (6).

(8) Preparation of Final Report

The Draft Final Report was discussed at the Advisory Committee meeting on February 7th 2008 in Tokyo, and some suggestions were given to the team. Based on the suggestions and comments from the Steering Committee and the Advisory Committee, the Final Report was prepared in March 2008.

CHAPTER 2 SOCIO-ECONOMY AND DEVELOPMENT PLANS OF GHANA

2.1 Demography and Economy

(1) Demography

The total population of Ghana is estimated at 21.3 million in 2005. The population growth rate is 2.5% per annum from 2000 to 2005. About 55% of the population lives in rural areas. About 15% of the total population or 3.3 million people live in Accra City, the capital. It is estimated that about 2.77 million households operate a farm or keep livestock. About 90% of farm holdings are less than 2 ha in size. Major ethnic groups in Ghana are composed of the Akan in the south, the Gonja in the northwest, the Dagubani in the north, the Eve in the east, and the Ga-Adanbe in the central region.

According to the 1st Ghana Poverty Reduction Strategy (GPRS-1) published in 2000, poverty is widespread in the country, with 43% living below the poverty line. Poverty levels are substantially higher in rural areas, at 62% compared to 28% in urban areas. At the national level, almost 58% of those identified as poor are from households for which food crop cultivation is the main activity. Especially the rural population in the northern regions (Upper West, Upper East and Northern) occupies more than 50% of the group classified as extremely poor.

A life expectancy at birth is 57 years old, represented as 59 for females and 56 for males. The maternal mortality ratio is 1,600 per 10,000 live births. Prevalence of HIV/AIDs for adults of 15 to 49 years old in 2003 is 2.2% for females and 6.3% for male. Adult literacy (above 15 years old) rate is 74%, consisting 66% for female and 82% for male. The literacy rate is 70% in urban areas and 40% in rural areas, respectively.

(2) Economy

The country joined the Heavily Indebted Poor country (HIPC) group in 2002, and this has improved Ghana's external debt profile significantly. The macro economic indicators in recent years are shown in the following table:

Table 2.1 Macro Economic Indicators of Ghana

Particular	1995	2000	2004	2005
GNI	-	$6.5 bill.	$8.2 bill.	$10.0 bill.
GNI per capita	-	$330	$380	$450
GDP	$5.0 bill.	$6.5 bill.	$8.2 bill.	$10.7 bill.
GDP growth per annum	4.0%	3.7%	5.8%	5.8%
Inflation (*1)		27.2%	14.1%	14.8%
Composition GDP				
(i) Agriculture	38.8%	36.0%	37.9%	38.8%
(ii) Industry	24.3%	25.4%	24.7%	24.6%
(iii) Services	36.9%	38.6%	37.4%	36.6%

Note *1: GDP deflator, Source: Ghana Statistical Services

Ghana's economic growth under GPRS-1 (2002-2004) was led by the agricultural sector with 6% of annual average growth rate, followed by industry and services respectively with 5% and 4.7%. The agricultural sector is the most dominant sector of Ghana's economy in terms of contribution to GDP, export earnings, and employment of the country's labor force.

The major export commodities are cocoa, timber and gold. About 40% of the country's total export revenue (US$ 2,274 million) came from agricultural produce such as cocoa and timber in 2005. On

the other hand, about 24% of the country's total import expenditure (US$ 3,303 million) was for agricultural imports including livestock and fishery commodities. Of the agricultural imports, about 22% was for rice followed by wheat (about 7%) in 2002 to 2004 on average.

Table 2.2 Total and Agricultural Imports

(unit: $ million)

Item	2002	2003	2004	Average
Total Imports	2,749	3,299 .	3,861 .	3,303 .
Agricultural Sector* total	519 .	696 .	1,123 .	779 .
Agricultural Commodities	429 .	577 .	983 .	663 .
- Rice	112 .	155 .	243 .	170 .
(proportion to agr. import)	(23%)	(22%)	(23%)	(22%)
(ton)	(421,000)	(490,000)	(652,000)	(521,000)
- Wheat and flour	66 .	43 .	43 .	51 .
(proportion to agr. import)	(13%)	(6%)	(4%)	(7%)
(ton)	(193,000)	(258,000)	(258,000)	(236,000)

*Including fisheries and livestock. Source: FAOSTAT, International Trade Center.

2.2 Land Holding and Tenure

(1) General

Inadequacy of land administration, difficult access to land markets and careless land use for state land are the most serious factors to be improved for the stagnant growth of the socio-economy. Land administration has been operated by customary practices and enacted legislation in Ghana, which has brought a lot of serious land problems, and accelerated growth of the sluggish socio-economy. The government stated that GPRS-1 was a comprehensive strategy to reduce poverty and accelerate growth. In this strategy, development of social infrastructure, modernization of agriculture based on rural development, good governance, etc. are proposed in the medium-term. The land sector shall play an important role in attaining the goals of GPRS-1.

(2) Present land ownership

Land administration in Ghana is governed by both customary practices and enacted legislation. There are basically two types of land ownership, i.e. state lands and communal lands. State lands are defined as lands compulsorily acquired by the government for public use. In contrast, communal lands are in communal ownership, held in trust for the community or group by a stool or skin as symbol of traditional authority or by a family. In addition, sandwiched between state lands and private lands are vested lands, which is a form of split ownership between the state and the traditional owners. Seventy eight percent (78) % of the total land area of Ghana belongs to communal lands, 20% to the state lands and 2% to the vested lands.

Table 2.3 Community Land Management by Region

Region	Stool, Skin	Family	Region	Stool, Skin	Family
1. Upper West	○	▲	6. Western	□	
2. Upper East	○	▲	7. Central	□	▲
3. Northern	○	▲	8. Eastern	□	▲
4. Brong-Ahafo	□		9. Volta	■	■
5. Ashanti	□		10. Great Accra	□	▲

○: Traditional authority of skin prevails, □: Traditional authority of stool prevails, ■: Traditional authority of stool prevails in the north of Volta and family in the south of Volta, ▲: Partly family prevail, Source: JICA Study Team

The communal landownership prevailing in the regional level is shown in Table 2.3. Communal lands are managed by a custodian (a chief of stool or skin or a head of family) with the principal elders of the community. Any decisions taken by the custodian that affects rights and interest in the lands, especially the disposition of any portion of communal lands to non-members of the land holding

community, require the concurrence of the principal elders.

(3) Constraints on Land Administration

At present, there are a number of land sector constrains to be improved, as shown in the National Land Policy document. The problems in the agricultural sector are characterized as follows;

1) Inadequate land policy and legal framework,
2) Fragmented institutional arrangements and weak institutional capacity,
3) Lack of consultation with the state and the communities,
4) Underdevelopment of land registration system,
5) Compulsory acquisition by Government of large tracks of land without payment of compensation, and
6) Small revenue to the land owning stool (18%) and a shortage of transparency on accounting of the revenue to be distributed to the local organizations,

(4) Constraints on Lands Holding and Tenure

In the rural areas where food is produced, evolution of the economy is leading to competition for land. The lands trended become scarce especially in the southern parts of Ghana. The traditional tenure arrangements have been generally replaced by sharecropping systems called the Abunu and Abusa practices, prevailing in the some areas of the country notably the Western, Eastern, Central, Ashanti and Brong Ahafo regions. The sharecropping rate of land owner / tenant farmer is 1:1 for the farm proceeds in "Abunu", and 1:2 for the farm proceeds in "Abusa". Generally the farm proceeds are paid in kind. In these two systems the farmer cannot own the land.

These tenure arrangements do not provide incentives to the tenant and create a source of constant conflict between the landowner and the tenant/settler farmer, which hinder agricultural productivity. In addition, contractual leases with short and long terms for land rent also exist and the tenant pays fixed cash without consideration of the volume of farm proceeds. Both documents of the terms of sharecropping and the contractual lease for land rent are mostly not set out.

Disputes over grants on issues such as the term of years, lump sum payment, rents, transfer of acquired lands to third parties by tenant farmers without the knowledge and consent of landowners, type of crops to be cultivated, community services to be rendered by the tenant farmer, especially during festivals are common. Large tracts of lands acquired by tenant farmers which remain uncultivated and thereby denying indigenous people access to land to work on area also become a source of tension and dissent. These disputes and constraints are largely due to no documentation of farmland transaction. Furthermore, it sometime happens that at the demise of community land owners and settler tenants, successor community land owners dispute the validity of the successor tenant's title or the extent of the land granted by the predecessor community land owner. These situations have hindered agricultural productivity thereby affecting both the community land owners and settlers

(tenants).

On the other hand, the lands in the northern areas of Ghana are owned mainly by the chief of the stool community and an area of the lands are available enough for the landowners having enough lands to be able to give portions to other indigenous people for farming after the approval of the chief. Normally there are no fixed conditions or remunerations attached to the release of land. In the case of a settler farmer (tenants), the chief of kin can approve granting permission for release of lands. No conditions are attached in terms of remuneration. However, the settler farmers could maintain a good relationship with the community by giving some agricultural produce in kind at harvests and labor contribution to farm operation to the chief and the farm owner.

(5) Some Considerations for Agricultural Development

1) Scale of project and identification of boundary of community lands

In order to avoid disputes on land ownership among communities, the agricultural development project shall not cover plural community lands as much as possible and it shall be made within one community area for smooth project implementation. In the case that the project consist of lands extended over several communities, it is recommended that identification of the landownership of the project area shall be made prior to the formulation of the development plan with regards to the following issues: (1) coordination of land among the related communities by the related government land administration institutions, (2) cadastral survey and preparation of cadastral maps and (3) registration of the project lands.

2) Preparation of documentation in statutory form for land lease

Generally the contractual land lease agreement between the community landowners and farmers shifted from the other community (tenants) is not statutorily documented, which brings about irreclaimable disputes on land tenure conditions among them. Therefore, the land lease conditions shall be documented in the related governmental administration institutions. Especially special attention shall be paid on issues of the terms of the lease period. And a long lease period shall be considered as a prior condition for implementation of the project for security of tenant's position.

3) Improvement of share cropping practices such as Abunu and Abusa

For the agricultural development in the area where a share cropping arrangement prevails, improvement in tenancy shall be made for increase in agricultural productivity. Merits and demerits from the viewpoints both of landowner and sharecropper in sharecropping shall be clarified and agreeable tenancy conditions for both sides be identified.

4) Selection of beneficiaries and scale of farm size

It is recommended that the existing farmers shall be given the highest priority of participation in the projects. It is carefully considered that the allocated farm land to be allocated to the

beneficiaries shall be decided to fall within a certain range of area (1~2 acres for example) in view of the capacity of the family labor force.

5) Constraints for the irrigation development project

The government generally paid the compensation cost for the lands to the customary land owners and land ownership of all the lands of the systems belongs to the state. Simultaneously the state provides the participant farmers with the right of farming not landownership and the participants shall pay only the irrigation service charge (ISC) defined in each irrigation system. The irrigation system frees the participant farmers from serious tenure conditions like sharecropping if he/she were a tenant before implementation of the system.

On the other hand, the government has not paid compensation fees for the community landowners when it acquired land compulsorily from landowners. And statutory documents with regard to land acquisition between the government and community landowners were not made. These issues resulted in part of the project areas being seriously encroached and virtually sold out to housing developers by the traditional allodial land owners. Also, the tenure status of the beneficiaries in the existing irrigation projects was not secure as agricultural development projects under MOFA. In some irrigation projects, the beneficiaries who were shifted from other communities had to pay land rent fees to landowners who had owned lands before implementation of the irrigation projects in addition to irrigation service charges to GIDA. In the same way as for agricultural development projects, there are a lot of constraints and problems for land tenure in the irrigation development sector.

For implementation of the irrigation development project, the following issues shall be considered:

Formulation of legislative system of payment of prompt adequate and effective compensation as a condition for the compulsory acquisition of land by the government,

Identification of the potential of land tenure problems in the project area by conducting social surveys such as tenure status, the number of related communities and social features of those communities, present and past problems of land transaction, etc. before starting project, and

Coordination among the related communities in the project managed by the government land administration institution in order to minimize disputes on demarcation of community land of stool/skin and family boundary and to minimize expenses necessary for litigation.

2.3 Government Development Policy

(1) GPRS-1 and 2

The government of Ghana formulated a policy framework as the Ghana Poverty Reduction Strategy (GPRS-1, 2003-2005) in 2002 that was directed primarily towards the attainment of the anti-poverty objectives of the UN Millennium Development Goals (MDGs). The target of the GPRS-1 is to attain middle income stratus with a per capita income of at least US$ 1,000 by the year 2015 within a

decentralized democratic environment. However, there are two broad sets of constraints to achieving accelerated wealth creation and poverty reduction. These are (i) vulnerable to the economy and (ii) constraints regarding social structure. Accordingly, emphasis is placed on changing the structure of the economy by developing the private sector, diversifying the export base and increasing agricultural productivity and rural incomes.

In place of the GPRS-1, the Government is launching a new Growth and Poverty Reduction Strategy (GPRS-2, 2006-2009). The emphasis of GPRS-2 is on the implementation of growth-inducing policy and programs which have the potential to support wealth creation and sustainable poverty reduction. It is targeted in GPRS-2 that the economy grows at an annual rate of 6-8% is to attain middle income stratus with a per capita income of at least US$ 1,000 by the year 2015 within a decentralized democratic environment.

In order to achieve accelerated growth in Ghana's agriculture, a number of key interventions will be initiated to support agricultural productivity. In the area of crop production in particular, the following measures will be pursued:

- Ensure women's access to and control over land and agricultural inputs, including extension services,
- Promote and support large scale farming and nucleus out-grower schemes for production of targeted/elected crops,
- Enhance the productivity of small scale farmers by securing their access to extension, storage, price stability, credit, markets, and lands. Women small holder producers of food crops will be given needed impetus to improve their livelihood and assisted to benefit from the potential positive effects of linkages between agriculture, industry and exports,
- Develop and use improved seeds/planting materials,
- Intensify research-extension-farmer linkages to ensure that technologies are developed and disseminated appropriately to meet world-wide market standards,
- Promote and support the use off weights and measures as well as grades and standards in marketing of commodities so as to enhance commercial efficiency,
- Strengthen farmer-based organizations, with full participation of women farmers, to enhance access to credit and other services. The emasculation of the Ghana Cooperative movement, which had previously attained a pre-eminent position in cocoa marketing and the national savings,
- Improve storage/warehousing and distribution network, including refrigerated transport systems and cold storage facilities at the ports,
- Improve rural infrastructural network, particularly road-rail linkages,
- Promote the culture of community-based irrigation in order to move agriculture from reliance on the vagaries of the weather to a more scientifically managed system of assuring water, and

- Improve data collection, collation, analysis and dissemination of results within the industry.

(2) Government Agricultural Policy

Ministry of Food and Agriculture (MOFA) has implemented a Medium Term Agricultural Development Program (MTADP) which provided policy guidelines since 1991. In 1995, the government launched its "Vision 2020" which is designed to transform Ghana into a middle income country by the year 2020. In order to consolidate the gains made in the agricultural sector under the Economic Recovery Program and also effectively support "Vision 2020", MOFA initiated actions in 1995 towards the development of an Accelerated Agricultural Growth and Development Strategy (AAGDS).

The AAGDS was designed to be implemented over ten-years (2001-2010). To attain the goals set in its Vision 2020 program of social and economic development which is hinged on private-led and export-oriented growth, the AAGDS estimates that the agricultural sector's growth rate of 4.0% envisaged under Vision 2020 shall increase to at least 6.0% per annum over the medium term (2001-2010) to achieve rapid, sustainable, and equitable growth through the measures in box on the right.

Measures taken in AAGDS

1. Promotion of selected products through improved access to markets
2. Development and improved access to technology for sustainable natural resources management
3. Improved access to agricultural financial services
4. Improved rural infrastructure, and
5. Enhanced human resource and institutional capacity

The AAGDS outlined strategies to transform the agricultural sector through the formation and implementation of policies and programs. The first of these was "the Agricultural Services Sub-sector Investment Programs (AgSSIP)", which addresses element 1, 2 and 5 in the above box. The other elements, improved access to agricultural financial services and improved rural infrastructures, are partly addressed by "the Village Infrastructure and Rural Financial Services Projects". The proposed Agricultural Development Fund (ADF) was expected to complement these two facilities.

"The Food and Agricultural Sector Development Policy (FASDEP)" was formulated in 2002 with a focus on providing a holistic policy framework in addition to an urgent need to modernize (commercialize) agriculture with an emphasis on the linkages among production, storage, processing, preservation, packaging, and marketing, as

Major Elements in FASDEP

1. Enhanced human resource development and institutional capacity building
2. Improved financial services delivery (improving access to credit, strengthening rural financial institutions, mobilization of funds, specialized lending services and establishment of the agricultural development fund)
3. Development, dissemination and adoption of appropriate technology: (1) crop: development and dissemination of improved varieties of seeds and planting materials, crop improvement / adaptation and multiplication of introduce varieties, improvement of farm level operations and post-harvest handling, (2) approach to technology dissemination: strengthening of farmer based organization, private sector participation in extension, research-extension-farmer linkages and HIV/AIDs, gender , and equity
4. Infrastructure development (development/rehabilitation of irrigation systems and water management, agricultural land, transportation systems, machinery, equipment and tools), and
5. Promotion of selected commodities and improved access to markets (selected commodities for food security, agricultural raw materials for industry, agricultural commodities for export, improved access to input and output markets commodity coordinators).

well as linkages among the various agricultural sub-sectors and the non-agricultural sectors. The FASDEP aims at achievement of the following five major elements in line with the AAGDS;

The FASDEP adopts a sector-wide approach to managing agricultural development as opposed to the discrete project approach pursed in the past. It is the strategic framework within which all on-going and future programs and projects will operate. It provides a broad framework for agricultural development out of which detailed projects and program implementation plans and activities will be developed to deal with specific issues. At present, the donor agencies impose conditions for support and retain their own procurement and disbursement procedures. FASDEP will avoid duplication and waste in this procedure by making efforts to bring all donor-funded projects within a coordinated framework by harmonizing procurement, disbursement, and reporting procedures. In addition, this policy framework identifies the private sector as the engine of growth and market access as a major key element required for its success.

The FASDEP is to ensure food security and promote import substitution. The thrust is to reduce rice imports by 30% by 2004 by increasing production levels to about 370,000 tons. However, the production target could not be realized yet. Specific measures to reach this level of production were planned covering increased mechanization, increased cultivation of inland valleys and effective and efficient utilization of the existing irrigated systems. In addition, varietal improvement and increased seed production and utilization were pursed. The provision of credit for production, improved production and marketing were covered.

Based on the progress of FASDEP and the economic growth of the country, "the Food and Agricultural Sector Development Policy II (FASDEP II)" (2007 to 2012) was published in August 2007. In this policy, the focus points are listed in the box on the right.

Focus Points in FASDEP II

1. Food security and emergency preparedness (selected five staple crops: maize, rice, yam, cassava and cowpea)
2. Improved growth in incomes
3. Increased competitiveness and enhanced integration into domestic and international market,
4. Sustainable management of land and environment
5. Science and technology applied in food and agricultural development
6. Enhanced institutional coordination

A Strategic Plan (2008 to 2010) was prepared as an action plan of FASDEP II in August 2008 and is awaiting Cabinet approval. The Strategic Plan identifies the specific constraints and proposes priority intervention, particularly on strategic food stocks of selected commodities and value chain development. Rice is the one of selected food crops to improve the entire sector from production, processing, marketing to consumption. In the irrigation sector, public-private partnership and such low cost facilities as small pumps are to be encouraged. Based on the agricultural policy, the following projects and programs related to the rice sector have been implemented:

Table 2.4 Rice Related Projects and Programs

	Project Title	Period	Components	Agency (Donor)
1.	Small Scale Irrigation Development Project	2000 – 06 loan closed	15 small irrigation schemes (2,590ha in Volta, East, Brong Ahafo, Northern, Upper East & Upper West)	GIDA (AfDB)
2.	Agricultural Services Sub Sector Investment Program	2001 - 06 loan closed Phase 2 under pipeline	Strengthening agricultural research and extension, institutional reform of MOFA, development of farmer-based organizations (whole country), mostly for budgetary support to agriculture sector	MOFA (WB), Environment, Science & Technology Employment & Social Welfare
3.	Inland Valley Rice Development Project	2004 - 07 to be extended	Inland rice development (4,500ha in 25 villages of Ashanti, Brong Ahafo, Central, Eastern & Western)	MOFA CSD (AfDB)
4.	Small Farms Irrigation Project, Phase II	2003 - 08 on-going	Irrigation development (820ha in 11 schemes of Ashanti, Brong Ahafo, Central, Eastern, Western & Volta)	GIDA (Arab Bank for African Development)
5.	Rehabilitation of Nine Irrigation Projects	2000 - 06 loan closed	Rehabilitation of existing irrigation schemes (2,200ha, Tanoso, Akumandan, Afife, Bontanga, Kpandu-Torkor, Subinja, Aveyime, Sata & Weija)	GIDA (WB)
6.	Small-Scale Irrigated Agriculture Promotion Project (SSIAPP) and Its Follow-up	1997 - 2001 completed 2002 - 2004 completed	Irrigation development, extension of farming technology, cooperative developments (Ashaiman/56ha in Greater Accra, Okyerko/81ha in the Central region)	GIDA (JICA)
7.	Project for Promotion of Farmers' Participation in Irrigation Management (FAPIM)	2004 - 2006 completed	1) Establishment of farmers' participation in irrigation management in GIDA schemes, 2) Strengthening of GIDA's function in service delivery on irrigation farming	GIDA (JICA)
8.	Grant Assistance for Underprivileged Farmers	2006 - 2007 on-going	Supply of agricultural machinery and equipment (tractors, power tillers, rice mills, pumps), monitoring and evaluation.	MOFA AESD (JICA)
9.	Nerica Rice Dissemination Project	2004 – 2010 on-going	Increase of rice production and reduce rice import through enhancement of access to high yielding NERICA upland rice, with contribution to poverty reduction and food security.	MOFA CSD (AfDB)
10.	Lowland Rice Development Project (LRDP)	1999 - 2003 loan closed	Development of lowland rice production in the Northern region (1,200 ha)	MOFA CSD (AfDB)
11.	Food Security and Rice Producers Organization Project (FSRPOP)	2003 - 2007 under pipeline	1) Establishment and strengthening of the rice sector organization (GRIB: Ghana Rice Inter-professional Body), 2) Improvement of production, processing and marketing of local rice (follow-up of LRDP)	MOFA CSD (AfDB)
12.	Support to the Rice Sector in Northern Ghana	2007 - 2012 on-going	Follow-up of FSRPOP, 1) Lowland rice development of 6,000 ha in 4 regions (Upper West, Upper East, Northern and Volta), 2) Support and strengthening to FBOs, 3) Access to credit, 4) Support to GRIB	MOFA CSD (AfDB)
13.	Land Administration Project	2004 - 2009 on-going	Rationalizing land policy and legislative framework, institutional reform, improving land titling, registration, valuation and information system	Ministry of Land, Forestry and Mines (WB)

Note; AfDB: African Development Bank, CSD: Crop Service Directorate, WB: World Bank, AFD: Agence Francaise de Development, AESD: Agricultural Engineering Service Directorate. Source : MOFA, GIDA, others

As shown in the above table, donors supporting the rice sector are JICA, AFD and AfDB. The projects covering wide area in the longer term are the GRIB Support and Lowland Rice Development Projects under AFD, and the Inland Valley Development and Nerica Rice

Table 2.5 Budget of Ministry of Food and Agriculture

(unit: cedi billion)

	GOG	IGF	Donor	Statutory Fund HIPC Facility	Total
Agriculture	338	4.8	689	174	1,206
(proportion)	28.0%	0.4%	57.2%	14.4%	100.0%
Total Gov't	19,926	2,236	8,966	7,572	38,698
(proportion)	51.4%	5.8%	23.2%	19.6%	100.0%

Note: GOG: Government of Ghana (tax revenue), IGF internal generated fund.
Source: Ministry of Finance and Economic Planning.

Dissemination Projects under AfDB.

The MOFA budget for 2007 is shown in Table 2.5 on the right. Out of the total MOFA budget, allocation from the government revenue is 338 cedi billion (below 30% of total budget), consisting of 194 cedi billion for recurrent expenditure and 144 cedi billion for development expenditure. Implementation of projects and programs are mostly implemented by the donor support, which accounts for 60% of MOFA budget. In this financial situation, limited allocation of the government revenue would be in short for rice sector development. Implementation of projects and programs are mostly implemented by the donor support, which accounts for 60% of MOFA budget. In this financial situation, limited allocation of the government revenue would be fur short for the rice sector development. On the other hand, many rural development projects have been implemented where agriculture is the main economic activity. If these rural development projects involve rice sector for farmers' income generation, rice sector development would be reinforced.

In parallel with MOFA development activities, the US government has been implementing the Millennium Challenge Account (MCA) through the Millennium Challenge Corporation (MCC). MCC pledged in 2006 about US$550 million grant as the MCA Compact for Ghana, one of the largest grant recipient countries among 34 countries scheduled under MCA. The MCA Compact consists of three projects, namely agriculture, transportation and rural service development. Components under each project and their costs are listed below:

Table 2.6 Components of Millennium Challenge Account

Project	Component (Activity)	Amount
1. Agriculture	- Commercial training activity - Irrigation activity - Land activity - Post-harvest activity - Credit activity, Feeder road activity	US$255.3 million
2. Transportation	- N1 road activity - Trunk road activity - Ferry activity	US$126.7 million
3. Rural Service Development	- Procurement capacity activity - Community service activity - Financial service activity	US$73.1 million
4. Other activities	- Monitoring and evaluation - Program administration & audit	US$80.0 million
Total		US$535.1 million

Source: Millennium Challenge Account Proposal, June 2006

The progress has been behind schedule due to delay in approval, and consultant procurement is ongoing at the end of September 2007. The target areas are 23 districts, called as the Intervention Zones, of 5 districts in Northern Zone, 6 districts in Afram Basin Zone and 12 districts in Southern Zone. It is expected that improvement of roads and business capacity building would be improve the progress of agricultural development in the project area as shown below:

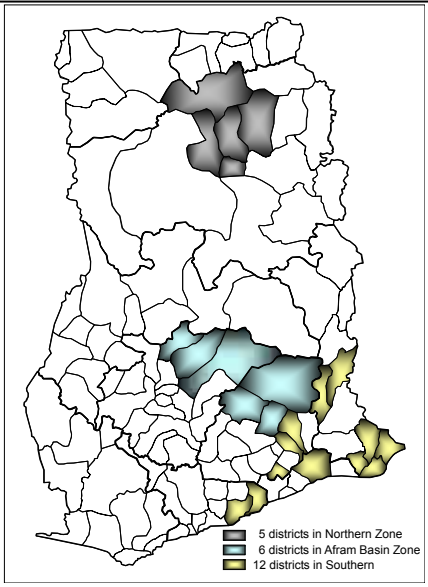
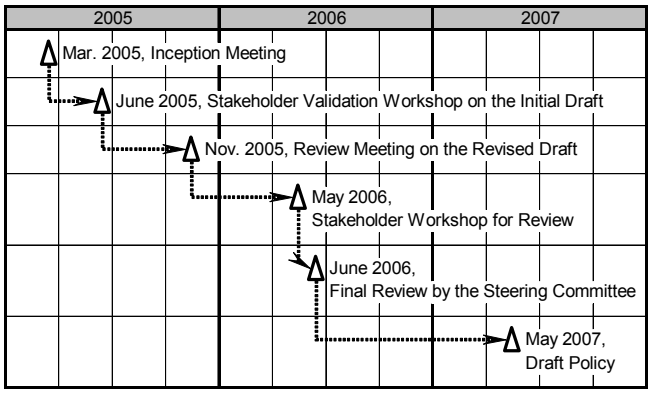


Figure 2.1 Intervention Zones of MCA

(source: same as Table 2.6)

(3) Draft National Irrigation Policy

MOFA and GIDA have been formulating the national policy for improvement of irrigation development and management in Ghana, under the collaboration of FAO and IWMI since March 2005, and the draft National Irrigation Policy, Strategy and Regulatory Measures was prepared in May 2007 for cabinet approval. In the formulation process, the following steps have been taken; 1) Inception workshop in March 2005, 2) A stakeholder validation workshop on the Initial Draft Irrigation Policy June 2005, 3) A review meeting on the draft irrigation policy and strategy in November 2005, 4) Review in May 2006, 5) Final review of the Steering Committee in June 2006, as shown in the right figure.



Source: Draft National Irrigation Polocy, Strategy and Regulatory Measures, May 2006, MOFA & FAO

Figure 2.2 Steps for National Irrigation Policy

In the policy, the irrigation sector is classified into 3 categories of 1) Informal irrigation, 2) Formal irrigation, and 3) Large scale commercial irrigation, and the details of each category are given in the table below:

Table 2.7 Categories / Sectors of Irrigation under the Policy

Category / Sector	Description
Informal Irrigation	- Irrigation practiced by small individual farmers (up to about 0.5 ha) - Simple structures and equipment for water storage, conveyance and distribution - Small capital investment from the farmers' own resources (currently not depend on the public infrastructure for water supply) - Manual fetching of water by cans and bucket, motorized pump & hoses - Lack of recognition resulted in limited access to credit and tenure security
Formal Irrigation	- Permanent irrigation structure funded by the public sector - 22 GIDA irrigation schemes, about 9,000 ha under irrigation from the potential 14,700 ha - 300,000 ha of irrigation in the government plan
Large Scale Commercial Irrigation	- Category under both formal and informal - Formal sector: the intake headworks and primary distribution system provided by the government, while the secondary distribution system by the private investors - Informal sector: the intake headworks and the rest of the infrastructures and equipment is provided by private investors - Large scale commercial irrigation, ranging from 25 ha to 1,000 ha, is usually export-oriented for high value fruits and vegetables

Source：Draft Irrigation Policy, Strategies and Regulatory Measures, May 2007, MOFA and FAO.

CHAPTER 3 PRESENT SITUATION OF RICE PRODUCTION

3.1 Rice in Food Crop Production

Table 3.1 Food Crop Production of Ghana (1996 - 2005)

Crops	Production (1,000 ton)	
Cereals	1,720	(11%)
- Maize	1,000	
- Rice (Paddy)	250	
- Millet	160	
- Sorghum	310	
Starchy Root	12,030	(76%)
- Cassava	7,500	
- Yam	2,960	
- Cocoyam	1,570	
Plantain	2,040	(13%)

Source: MOFA Agricultural Statistics & Census Division: PPMED and Statistics, Research and Information Directorate: SRID

Food crops produced in Ghana are categorized into three groups, i.e. cereals, root crops (starchy root) and plantain. The average crop production in the period of 1996 - 2005 is summarized on the left.

The Ghanaian diet is characterized by its diversity. The total cereal production amounts to 1.72 million ton, which is equivalent to 83 kg per capita on the basis of 20.53 million of the total population in 2003. Food demand is not fulfilled only by cereals but supplemented by root crops and plantain. However, the importance of cereals is emphasized taking into account their higher dry matter contents. The dry matter content of cereals are as high as 80%, while that of root crops is limited to 20% to 30%. Cereals contain more carbohydrates and nutritional values. In addition, cereals can be easily cooked and stored for longer period than root crops. With such advantages, cereals become more valuable for Ghanaians than their appearance in the agricultural statistics. Figure 3.1 presents the past trend of cereal production in Ghana (details are referred to Attachment-3(1)). The cereal production reached a level of 2.0 million ton in 2001 due a significant increase of maize production. On the other hand, production of rice, millet and sorghum is stagnant in the last decade. As a result of the rapid change of lifestyle and food habit in urban areas, rice consumption in Ghana has sharply increased. To make up for shortages of domestic rice, Ghana annually spends over 100 million US dollars for rice imports, e.g. US$ 185 million in 2005. This means that increased domestic rice production will contribute directly to foreign currency savings and balance of payment. Needless to say, increased rice production will contribute also to improvement in the farmers' economy.

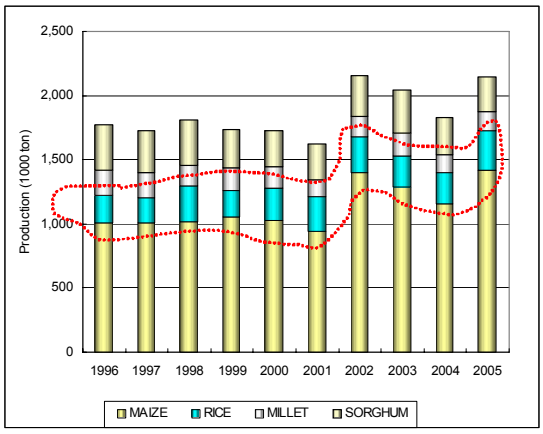


Figure 3.1 Past Trend of Cereal Production (1996-2005)

Source: MOFA Agricultural Statistics & Census Division: PPMED

3.2 Regional Characteristics in Rice Production

(1) Agro-climate and food crop production

The Ghana Soil Research Institute (SRI) carried out a land suitability analysis under the Ghana Environmental Resource Management Project (GERMP) in 1999 under the support of FAO. The

land suitability analysis aimed at assessment of land potentials for crop production on the basis of agro-ecological zones (AEZ) defined by the water holding capacity of soils and ratios of rainfalls over evapo-transpiration. The analytical results were to be utilized for rationalized land use planning for each AEZ of Ghana.

The GERMP worked out a thematic map on the length of growing period zones for annual crops presented in Figure 3.2. The length of growing period of crops in the central to southern parts of Ghana extends to around 300 days a year. This means that annual crops can be planted nearly throughout the year, while the length of growing period of crops is shortened to 90 days to 120 days a year in the northern part.

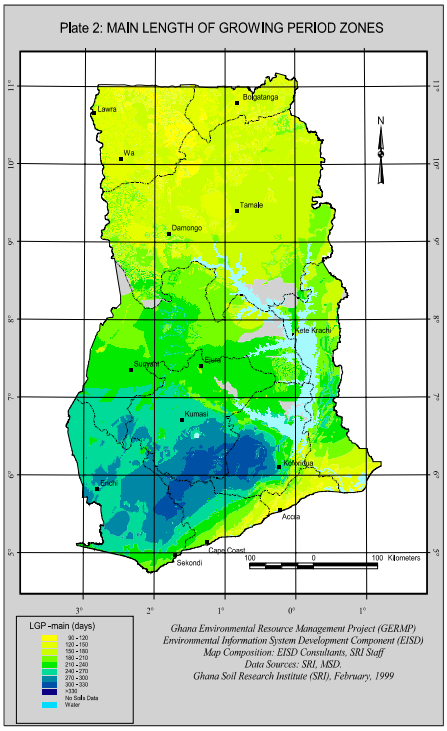
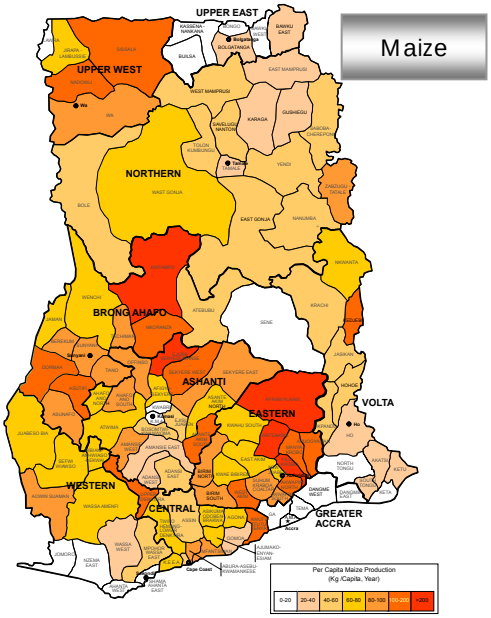


Figure 3.2 Length of Growing Period Zones

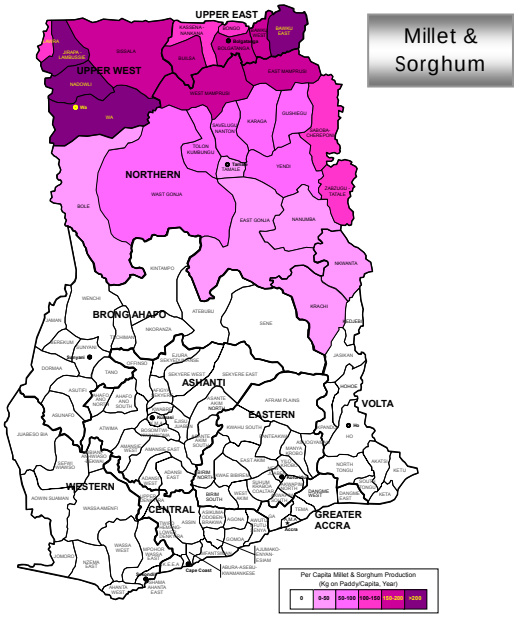
Source : SRI- GERMP 1999

Crop selection is also discussed in the GERMP. Root crops can be broadly planted in the central to southern parts of Ghana, while drought tolerant cereals, i.e. millet and sorghum, are planted mainly in the northern parts of Ghana.

In order to indicate the locality, crop production per capita was calculated by district on the basis of the 2003 population as illustrated in Figure 3.3.



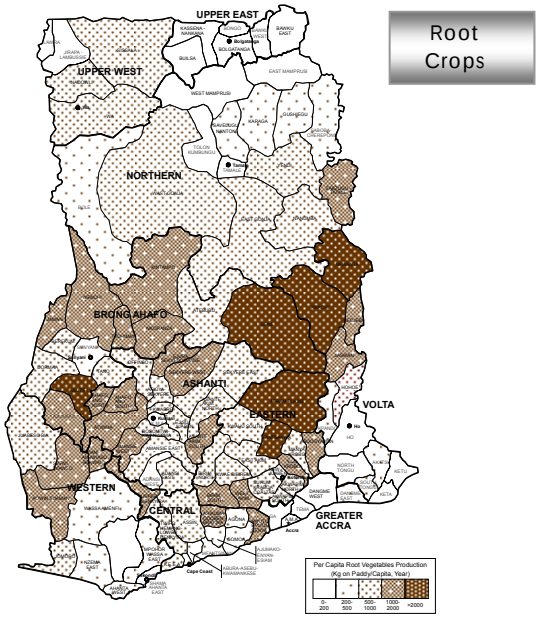
Per Capita Maize Production by District (2000)



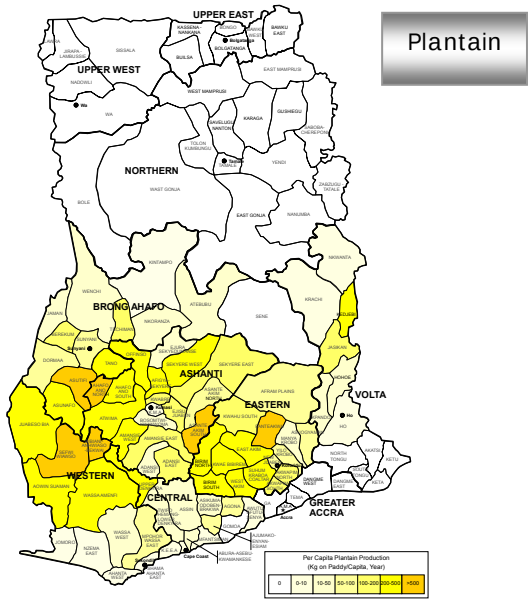
Per Capita Millet & Sorghum Production by District (2000)

Source: 2000 Population & Housing Census: Summary of Final Result. Ghana Statistical Services,2000.
Production of Major Crops 2000: Statistics, Research and Information Directorate (SRID), MOFA, Feb. 2001.

Figure 3.3 Per Capita Crop Production by District (1/2)



Per Capita Root Vegetables Production by District (2000)



Per Capita Plantain Production by District (2000)

Source: 2000 Population & Housing Census: Summary of Final Result. Ghana Statistical Services,2000.
Production of Major Crops 2000: Statistics, Research and Information Directorate (SRID), MOFA, Feb. 2001.

Figure 3.3 Per Capita Crop Production by District (2/2)

(2) Rice production by region

The per capita rice production in each region was calculated on the basis of rice production and population in 2003. The results are illustrated in Figure 3.4. The per capita production in the Northern, Upper East and Volta regions exceeds 20 kg in paddy (13 kg in rice). In particular, the Northern region exceeds 48 kg in paddy (31 kg in rice). These three regions produce over 70% of national production.

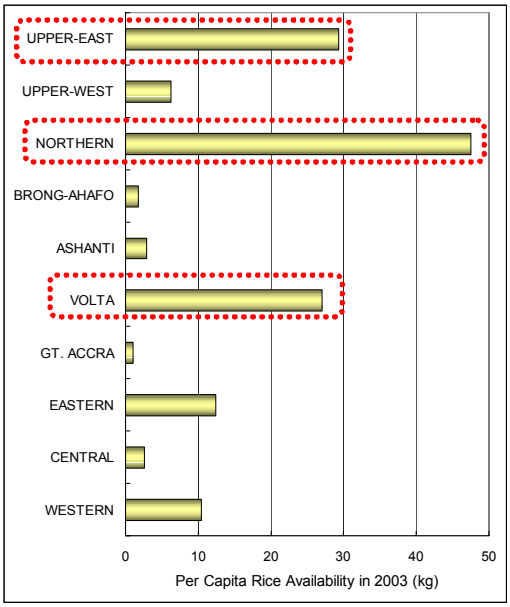


Figure 3.4 Per Capita Paddy Production (2003)

Source: MOFA Agricultural Statistics & Census Division: PPMED and Statistics, Research and Information Directorate: SRID

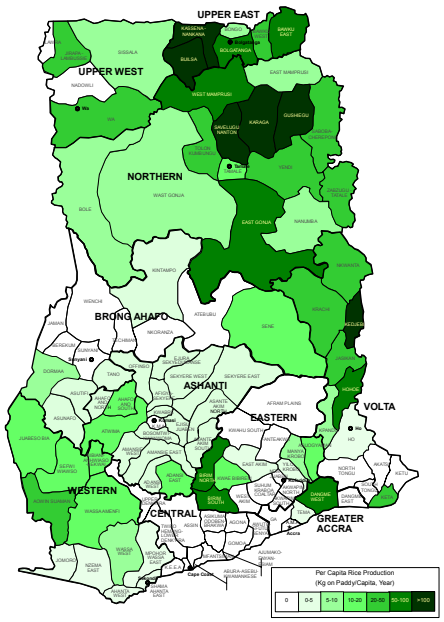


Figure 3.5 Per Capita Rice Production by District (2000)

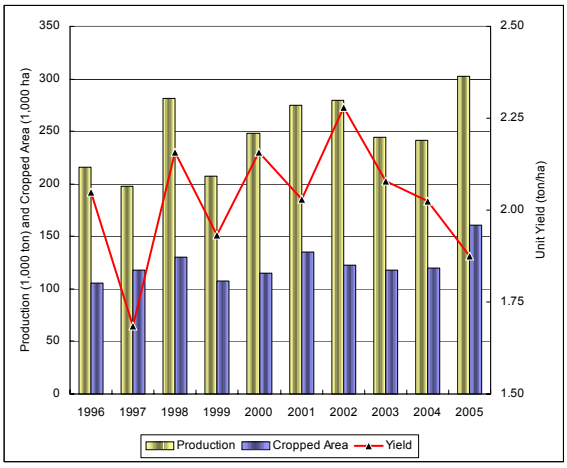
Source: 2000 Population & Housing Census (. Ghana Statistical Services), Production of Major Crops 2000 (MOFA)

The per capita production of rice by district is illustrated in Figure 3.5. The map shows different distribution patterns from other crops. Rice is produced nation-widely. It is planted on scattering patches of low-lying land such as inland valleys and swampy lands. Soil moisture on low-lying land is kept mostly throughout the year by collecting rain water from watershed or being fed by high groundwater. Higher moisture contents are not preferable for upland crops but for rice. In view of effective land use, rice is an advantageous crop.

Rice in Ghana is planted for both home consumption and income generation. Farmers are encouraged by rice farming with higher marketability than other cereals. In 1970s and 1980s market-oriented rice farming was introduced under irrigation development even in Savanna zones, i.e. Northern and the Upper East regions as seen in Figure 3.5. Rice produced in those regions is distributed to Kumasi and even to Accra as Bolga rice is of higher market value.

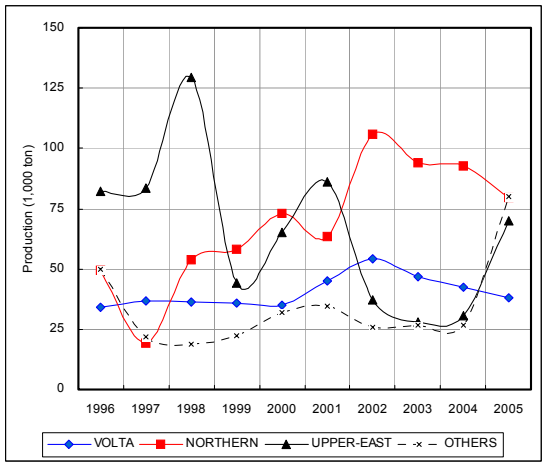
3.3 Planted Area and Average Yield of Rice

Figure 3.6 shows the past records of paddy production of Ghana in 1996 - 2005. Paddy production was in the range of 200,000 tons and 300,000 tons with large annual fluctuation. The ranges of unit yield and cropped area for paddy were between 1.7 and 2.3 ton/ha, and between 100,000 ha and 160,000 ha respectively during this period. Paddy production in each region has also fluctuated as seen in Figure 3.7 below. The total paddy production of the country is strongly affected by those in the three main producing regions, i.e. Northern, Upper East and Volta.



Source: Statistics, Research and Information Directorate (SRID), MOFA

Figure 3.6 Paddy Production in Ghana (1996-2005)

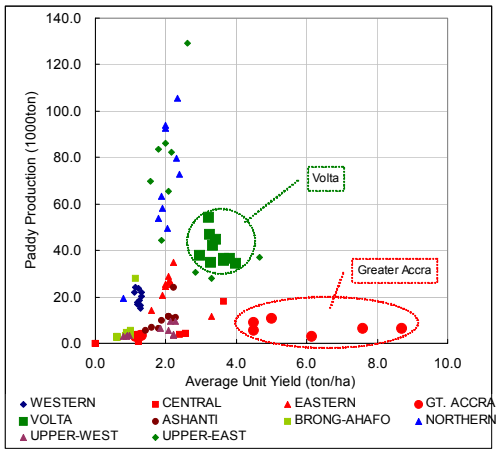


Source: Statistics, Research and Information Directorate (SRID), MOFA

Figure 3.7 Annual Paddy Production by Region

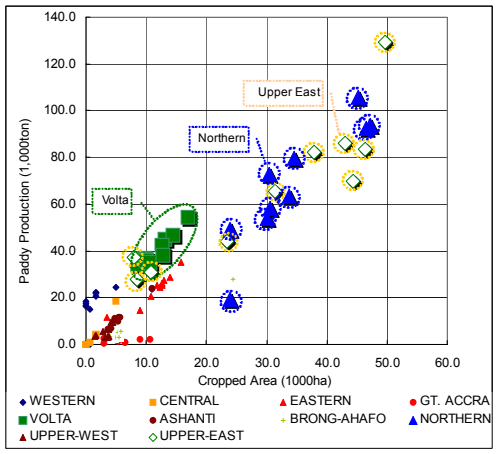
In order to know the main causes of annual fluctuation in paddy production, correlation between production and yield is analyzed. In Figure 3.8, each point indicates the relationship between paddy production and yield in each region and each year

No significant relationship is identified between paddy production and yield. In contrast, clear correlation is recognized between paddy production and planted area as shown in Figure 3.9.



Source: Statistics, Research and Information Directorate (SRID), MOFA

Figure 3.8 Relationship between Paddy Production and Yield (1996-2005)



Source: Statistics, Research and Information Directorate (SRID), MOFA

Figure 3.9 Relationship between Paddy Production and Planted area (1996-2005)

The past records suggested that annual fluctuation of planted area can be minimized in order to increase paddy production. Efforts should firstly be directed to improvement of physical and economic environment surrounding rice farmers in order to ensure sustainable rice farming on arable land. It is also crucial how to minimize abandonment of rice farming. In this regard, improvement of anticipated profits from rice farming is a central issue for farmers.

3.4 Rain-fed Rice Development

(1) Progress of Development

Paddy fields of Ghana consist of three types, as shown in Table 3.2. Out of 122,700 ha of total planted area of rice, 93,750 ha (77%) are categorized into lowland rain-fed paddy fields. Over 90% of paddy fields including upland paddy fields are planted under rain-fed conditions. As aforementioned, paddy is planted on low-lying land where hydrological conditions are favorable for rice. However, paddy production in Ghana fluctuates due to changes in planted areas and yields. Establishment of farming technology and land consolidation of paddy fields are urgently required to improve productivity. Positive impacts are expected to rain-fed paddy production under the development programs of both African Development Bank (AfDB) and French Development Agency (Agence Frensase Development: AFD).

Table 3.2 Categorization of Paddy Field in Ghana

	Lowland rain-fed	Upland rain-fed	Irrigated	Total
Planted Area	93,750 ha	18,750 ha	10,200 ha	122,700 ha
Paddy	2.4 ton/ha	1.0 ton/ha	4.5ton/ha	2.4 ton/ha
Paddy Production	224,700 ton	18,750 ton	45,900 ton	289,650 ton
% in Area	77%	15%	8%	100%
% in Production	78%	6%	16%	100%

Source: JICA Preliminary Study Report (Sept. 2005) and modified by the Study Team

(2) On-going Programs and Projects for Rain-fed Rice

1) Lowland Rice Development Project (LRDP)

With technical and financial assistance from AFD, MOFA embarked on lowland rice development

in the Northern region in 1999. The total program cost was estimated to be 2.67 million Euros, of which 2.29 million Euros were budgeted by the financial assistance of the AFD.

The program continued for 4 years until April 2003. Lowland paddy fields were consolidated with a total coverage of 1,151 ha, and beneficiary farmers are over 2,400 households. The average paddy yield was improved to 2.6 ton/ha. Some 13% of the total farmers achieved paddy yields as high as 4.0 ton/ha. With higher paddy yield most farmers reserved 710,000 cedi/ha/crop in net which enabled them to repay the crop credit. The repayment rates of the crop credit were 100% in 2000 and 86% in 2002.

The first phase of the program was completed in 2003 and followed by its second phase till 2007. The second phase is under preparation as of October 2007 to expand lowland rice development to another 6,000 ha in four regions of Northern, Upper West, Upper East and Volta during the period of 5 years from 2008 to 2012.

2) Inland Valley Rice Development Project (IVRDP)

The program aims at development of inland valleys for rain-fed rice in five regions, namely Brong Ahafo, Ashanti, Eastern, Central and Western. The project office is located in Kumasi of the Ashanti region.

IVRDP promotes the group formation of rice farmers and assists their paddy production for 0.5 ha/household regardless to farmers' present land holding size. The components of the program include civil works for such water resource development as construction of irrigation-drainage canals, land clearing - leveling and bund construction as well as technical and managerial support. Due to delay in contract for land development, the progress is far behind the initial schedule since the inception three years from 2005. While awaiting the commencement of civil work, some of the farmers groups already started development activities with minimal assistance from the project office, and some training and participatory research have been conducted through the extension agents and researchers from the Crop Research Institute.

The constraints of inland valley development are represented by traditional land tenure system especially in the southern parts of Ghana. Land owners are often reluctant to sign land lease contracts. In order to facilitate agreement on land lease contract, the program office intervenes between land owners and farmers by obtaining administrative supports of District Council. Rental fee prevailing in the regions is 50 kg of milled rice or 300,000 cedi in cash for 0.5 ha of paddy field per year.

3) Nerica Rice Dissemination Project (NRDP)

African Development Bank have been supporting NRDP for the seven countries of West Africa including Ghana under to increase rice production through enhanced access to high yielding upland NERICA rice varieties. The project aims to support the transfer of NERICA technology from WARDA and strengthen linkages between and among research, extension, farming

communities and the private sector.

Under the control of MOFA (Crop Services Directorate), the project is being carried out by CRI, SARI and GIDA in Ghana under four project components: a) technology transfer; b) production support; c) capacity building; and d) project coordination. Under the project, particularly for participatory seed selection and seed multiplication are implemented in three selected districts, namely Ejura-Sekyeredumasi (Kumashi), Tolon-Kumbungu (Northern) and Hohoe (Volta).

GIDA also assisted in production of foundation seed in the irrigated farms of two GIDA schemes, namely Ashaman and Okyereko.

4) Rice production program by MOFA

Table 3. 3 Rice Production Program 2005-2010

Category	Development Area	Paddy Yield	Paddy Production
Lowland & Inland Valley Rice	19,000 ha	4.0 ton/ha	76,000 ton
Irrigated Rice	6,000 ha	5.0 ton/ha	30,000 ton
Total	25,000 ha		106,000 ton

Source : MoFA

Cabinet Information Paper issued on 15th April 2005 stated the program for promotion of domestic rice production with development targets (Table 3.3) to be achieved by 2010. New development of lowland and inland valley rice is planned in Hohoe, Jasikan, Kpandu with a total coverage of 7,000 ha under IVRDP, 2,000 ha of extension and 10,000 ha in the northern country under EU/AFD. Extension of existing irrigation schemes is planned in both Aveyime in North Tongu Districts of the Volta region and Kpong in Kpong District of the Greater Accra region with a total extension area of 6,000 ha.

3.5 Irrigation Development for Rice Production

(1) Progress of Irrigation Development

The irrigation development potentials are estimated to be 1.9 million ha. On the other hand, the developed area is limited only to 19,000 ha (1.0%). There are 22 public irrigation schemes listed in Table 3.4. Ghana Irrigation Development Authority (GIDA) has provided the technical assistance to them since 1960s. The total developed area amounts to 8,700 ha out of 14,700 ha of potential area.

Table 3.4 Salient Features of 22 Irrigation Schemes

No.	Name of Scheme	Region	District	Const-ruction completed	No. of House-hold	Area (ha)			Irrigation System	Crops
						Potential	Developed	In use		
1	Afife	Volta	Ketu	1983	1,024	950	880	880	Gravity	Rice, Okra
2	Aveyime	Volta	North Tongu	1975	83	80	60	0	Gravity, Pump	Rice
3	Anum Valley	Ashanti	Ejisu-Juabeng	1991	115	140	89	0	Pump	Rice, Okra, Pepper
4	Bontanga	Northern	Tolon-Kumbungu	1983	550	570	450	390	Gravity, Pump	Rice, Maize, Pepper, Okra
5	Golinga	Northern	Tolon-Kumbungu	1974	80	100	40	16	Gravity	Rice, Maize, Pepper, Okra
6	Ashiaman	Greater Accra	Tema	1968	120	155	155	56	Gravity	Rice, Maize, Pepper, Okra
7	Dawhenya	Greater	Dangme	1978	235	450	200	150	Gravity,	Rice

No.	Name of Scheme	Region	District	Const-ruction completed	No. of House-hold	Area (ha)			Irrigation System	Crops
						Potential	Developed	In use		
		Accra	West						Pump	
8	Okyereko	Central	Gomoa	1976	131	111	81	42	Gravity, Pump	Rice, Chilies, Okra
9	Kikam	Western	Nzema East	-	22	27	27	0	Pump	Rice
10	Vea (ICOUR)	Upper East	Bolgatanga	1980	2,000	1,197	850	500	Gravity	Rice, Tomato, Sorghum.
11	Amate	Eastern	Amate	1980	127	203	101	0	Gravity, Pump	Maize, Pepper
12	Dedeso	Eastern	Fanteakwa	1980	69	400	20	8	Sprinkler	Tomato, Pepper
13	Tanoso	Brong Ahafo	Techiman	1984	211	115	64	15	Sprinkler	Okra, Maize, Cowpea
14	Sata	Ashanti	Sekyere West	1993	52	56	34	24	Gravity	Okra, Maize, Cowpea
15	Mankessim	Central	Mfantsiman	1978	32	260	17	17	Pump	Water Melon, Sweet Potato
16	Akumadan	Ashanti	Offinso North	1976	97	1,000	65	0	Sprinkler	Tomatoes, Maize, Cowpea
17	Subinja	Ashanti	Wenchi	1976	32	121	60	6	Sprinkler	Eggplant, Pepper, Okra
18	Libga	Northern	Savelugu	1980	41	20	16	16	Gravity	Rice, Maize, Pepper, Okra
19	Weija	Greater Accra	Kasoa	1984	171	1,500	220	0	Sprinkler	Pepper, Tomato, Cabbage
20	Kpong	Greater Accra	Kpong	1968	2,300	3,028	2,786	616	Gravity	Rice, Passion fruit
21	Kpando-Torkor	Volta	Kpando	1976	106	356	40	6	Sprinkler	Okra, Maize
22	Tono (ICOUR)	Upper East	Kassena Nankane	1985	3,250	3,860	2,490	2,450	Gravity	Rice, Soy Bean, Tomato
Total					10,848	14,699	8,745	5,192		

Source：Report on Evaluation of the Impact of the Project on Farmers' Participation in Irrigation Management (FAPIM), 2006

Out of 8,700 ha of the existing irrigation area, 5,200 ha (60%) are currently used for production of rice, maize, vegetables, etc. The planted area of rice has been gradually decreased through crop diversification to vegetables of high value. However, rice is still the main crop in the irrigation schemes of Ghana. As presented in Table 3.5, 4,240 ha (83%) of the above-mentioned 5,200 ha are planted with the rainy season paddy. Paddy is also planted by 1,470 ha in the dry seasons. The average paddy yields are 4.2 ton/ha in the rainy seasons and 3.5 ton/ha in the dry seasons, which suggest necessity of further assistance for yield improvement.

Table 3.5 Planted Area, Paddy Production and Yield of the GIDA Schemes

No.	Name of Scheme	Rainy Season Paddy			Dry Season Paddy		
		Planted Area	Production	Paddy Yield	Planted Area	Production	Paddy Yield
1	Afife	880.0 ha	4,600.0 ton	5.2 ton/ha	-	-	
2	Aveyime	-	-		-	-	
3	Anum Valley	-	-		35.0 ha	132.5 ton	3.8 ton/ha
4	Bontanga	152.5 ha	509.8 ton	3.3 ton/ha	271.6 ha	900.0 ton	3.3 ton/ha
5	Golinga	-	-		31.0 ha	124.7 ton	4.0 ton/ha
6	Ashaiman	14.8 ha	76.3 ton	5.2 ton/ha	10.4 ha	76.7 ton	7.4 ton/ha
7	Dawhenya	50.0 ha	-		-	-	
8	Okyereko	45.0 ha	225.0 ton	5.0 ton/ha	-	-	
9	Kikam	-	-		-	-	
10	Vea (ICOUR)	71.0 ha	211.0 ton	3.0 ton/ha	68.0 ha	306.5 ton	4.5 ton/ha
11	Amate	-	-		-	-	

No.	Name of Scheme	Rainy Season Paddy			Dry Season Paddy		
		Planted Area	Production	Paddy Yield	Planted Area	Production	Paddy Yield
12	Dedeso	-	-		-	-	
13	Tanoso	-	-		-	-	
14	Sata	-	-		-	-	
15	Mankessim	-	-		-	-	
16	Akumadan	-	-		-	-	
17	Subinja	-	-		-	-	
18	Libga	8.0 ha	40.0 ton	5.0 ton/ha	9.2 ha	46.0 ton	5.0 ton/ha
19	Weija	-	-		-	-	
20	Kpong	2,175.0 ha	10,156.5 ton	4.7 ton/ha	-	-	
21	Kpando-Torkor	-	-		-	-	
22	Tono (ICOUR)	840.5 ha	2,152.0 ton	2.6 ton/ha	1,044.5 ha	3,554.0 ton	3.4 ton/ha
	Total	4,236.8 ha	17,970.6 ton	4.2 ton/ha	1,469.7 ha	5,140.4 ton	3.5 ton/ha

Source：Report on Evaluation of the Impact of the Project on Farmers' Participation in Irrigation Management (FAPIM), 2006

(2) Current Positions of the GIDA Schemes

1) Small Scale Irrigated Agriculture Promotion Project (SSIAPP)

GIDA has been fully supporting operation and maintenance (O&M) to the irrigation schemes mentioned above since its establishment in 1977 by allocating government budget. In the beginning of the 1990s, the Farmers' Participatory Irrigation Management (FAPIM) was introduced to the GIDA schemes under the restructuring programs of World Bank/IMF.

In line with the recommendation of the World Bank in 1986, the management system of the irrigation schemes was reviewed paying special attention to (i) institutional improvement, (ii) farmer involvement, (iii) training, (iv) extension, (v) remodeling of scheme management including the break up into smaller units, privatization and creation of Water Users Associations. However, farmers did not understand the collection of water charges, resulting in deterioration of irrigation facilities due to lack of fund for O&M.

Further to this notion, a request was made by the Government of Ghana to the Government of Japan through JICA to assist in the improvement of irrigation practices. Technical co-operation was started in 1988, which was later developed into a project-type technical cooperation in model projects, i.e. the Small Scale Irrigated Agriculture Promotion Project (SSIAPP) at Ashaiman and Okyereko. The main goal of SSIAPP is to establish a sustainable farming system for small-scale irrigated farming and consequently to increase the income of farmers.

SSIAPP provided a wide range of technical assistance and training in farm input credit (FIC), irrigation service charge (ISC), reactivation of farmers' co-operative, key-players and marketing aspects in order to achieve improvement of farming technology, proper irrigation facility management and co-operative operation.

The follow-up project has implemented for two years to extend the positive impacts of SSIAPP experienced in the two model schemes to the other 20 schemes. A workshop for Action Plan Orientation (WAO) was also held to mobilize farmers for planning of co-operative actions in

order to identify and solve various problems in irrigation under GIDA.

In parallel, an Irrigation Development Center (IDC) was established in the Ashaiman scheme to accelerate technical transfer from the Japanese experts to the Ghanaian counterparts and other stakeholders. The facilities of IDC were fully used not only for technical training but also for rice research and seed multiplication, e.g. on-going NERICA variety trials under the Nerica Rice Dissemination Project supported AfDB.

3.6 Farm Management for Rice

(1) Rice Varieties and Seeds

Rice varieties prevailing in Ghana are categorized into the three categories of lowland, midland and upland on the basis of topographic positions of paddy fields and moisture conditions of soils. Varieties suitable for lowland are also planted under irrigated conditions. Major rice varieties in Ghana are listed in Table 3.6.

Table 3. 6 Rice Varieties in Ghana

Variety	Conditions of Paddy Fields	Growing Period	Anticipated Paddy Yield
GR 19	Irrigated/Rainfed Lowland	115-130 days	4.0 - 5.5 ton/ha
GR 21	Irrigated/Rainfed Lowland	115-130 days	4.0 - 4.5 ton/ha
TOX 3107	Irrigated/Rainfed Lowland	115-130 days	5.0 - 5.5 ton/ha
FARO 15	Irrigated/Rainfed Lowland	115-130 days	5.0 - 5.5 ton/ha
ITA 330	Irrigated/Rainfed Lowland	115-130 days	5.0 - 6.5 ton/ha
IR 12979-24-1	Midland/drought-prone lowland	110 days	
GR 18	Midland/drought-prone lowland	125-135 days	5.0 - 6.5 ton/ha
Shikamo (TOX 3108)	Midland/drought-prone lowland	90-103 days	
IRAT 262	Upland	90-105 days	2.5 ton/ha
ITA 330	Upland	90-105 days	2.5 - 3.0 ton/ha
IDSA 85	Upland	90-105 days	2.5 - 3.0 ton/ha
WAB 181-18-1	Upland	90-105 days	2.5 - 3.5 ton/ha

Source：Rice Production Guide (SARI)

Multiplication and distribution of certified seeds are not operational under nation-wide programs controlled by the Government. In almost all cases, certified seeds are produced to a limited extent within the framework of individual projects and programs. As a result of recurrent use of home-made seeds for years, productivity and quality of seeds tend to have deteriorated at the farmers' level. The mixture of off-type variety seeds and damaged seeds is outstanding.

In addition to the varieties listed above, Bouake, Wita 9, Jasmine 85 and IR64 are also sown in the several districts of Ashanti, Upper East and Greater Accra. Apart from the improved varieties, Mandii which is traditional red rice is sown in Upper West.

Variety trials for NERICA have been conducted during the period from 2004 to 2006 by JAICAF in several sites in Ghana including Crop Research Institute (Kumasi), SARI (Tamale) and Ashiaman Irrigation Scheme (Greater Accra).

(2) Crop Seasons

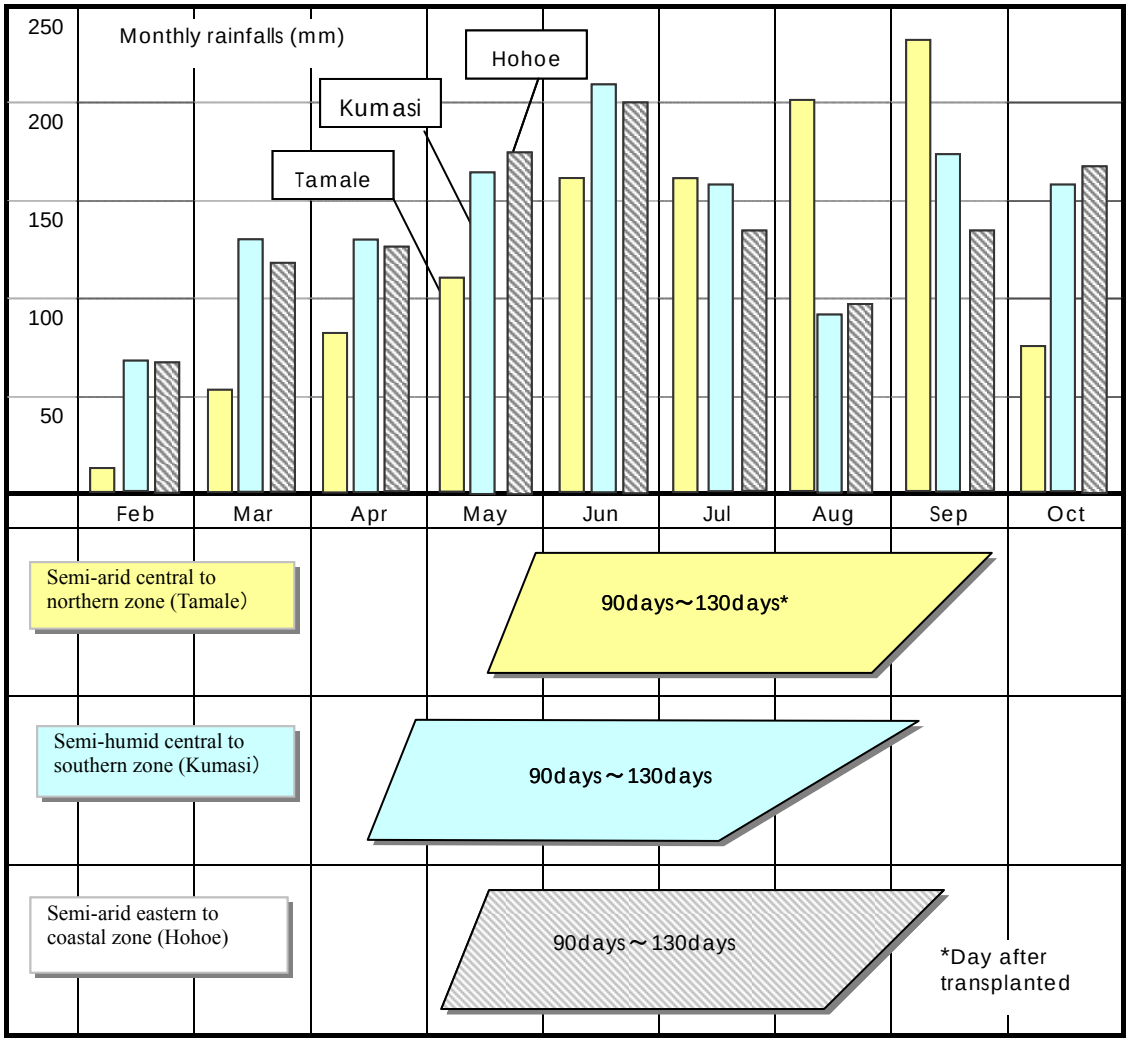
The rainy season in Ghana starts in May and ends in September, while the dry season starts in October and ends in April. Under the rain-fed conditions, the rainy season paddy is transplanted in April to May with seedlings of 30 days old and harvested in July to September. In parallel to harvesting of

the rainy season paddy, dry season paddy is planted in the inland valley. The double cropping of paddy is partly practiced under the irrigated conditions. The planting seasons of paddy are changed by AEZ. The GERMP divided the national land into the following three zones.

Semi-arid central to northern zone	:	Brong Ahafo, Northern, Upper West and Upper East
Semi-humid central to southern zone	:	Ashanti, Western, Central and Eastern
Semi-arid eastern to coastal zone	:	Greater Accra and Volta

With 90 to 130 days variety, the planting seasons of paddy are illustrated in Figure 3.10 below. In inland valleys, the dry season paddy is planted immediately after harvesting of the rainy season paddy. Under irrigated conditions, the double-cropping of paddy is operational only in six schemes out of 22 schemes although the cropping intensity remains at 150%.

It should be noted that the cropping seasons mentioned above are selected from a plant physiology point of view. Due to lack of agricultural machinery and delayed procurement of farm inputs, the crop seasons are incidentally delayed by three months at a maximum.



Source : SRI-GERMP

Figure 3.10 Cropping Patterns of Rain-fed Rice

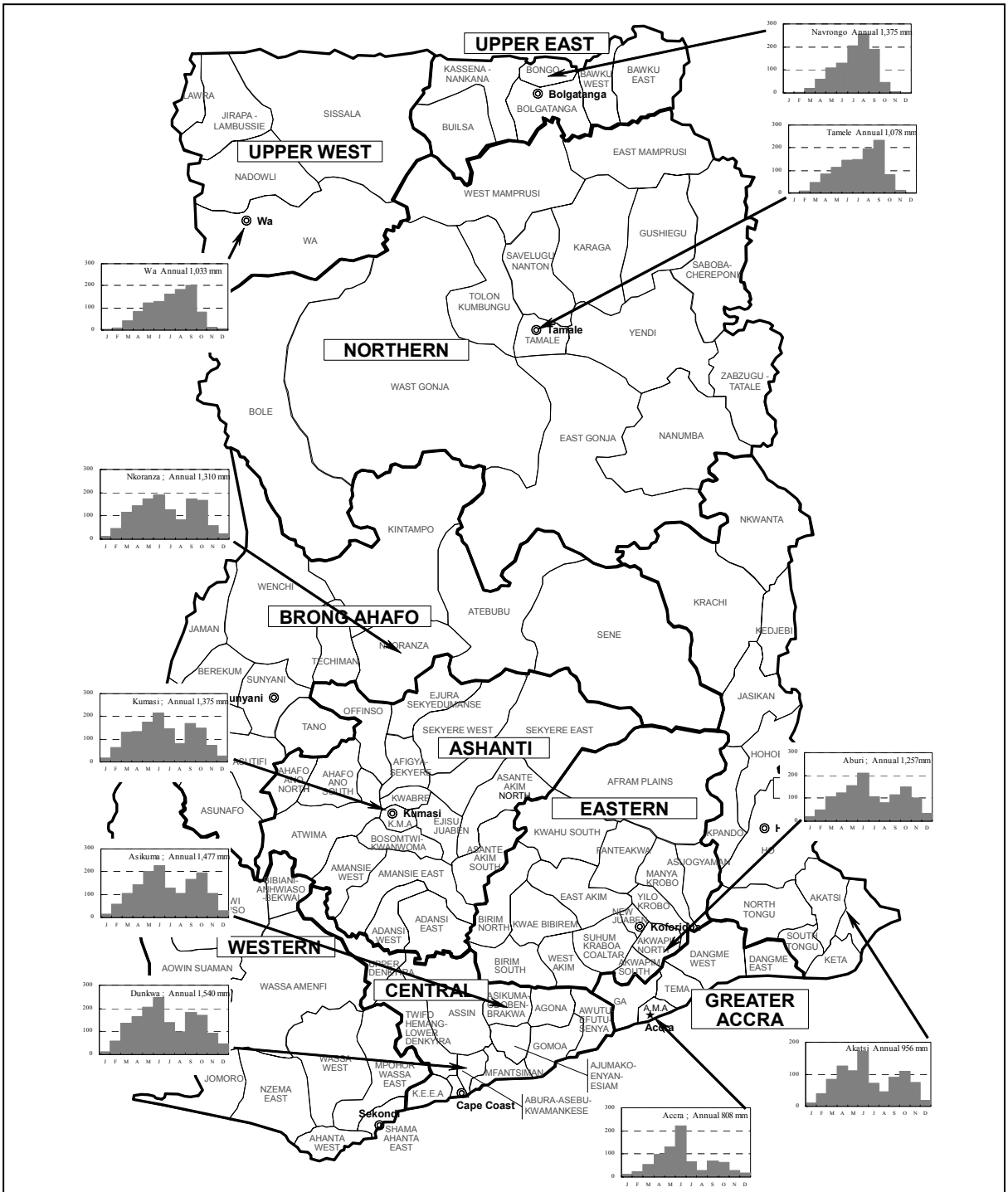


Figure 3.11 Mean Monthly Rainfall at Major Locations

(Source: GIDA, data in 1950s to 2000))

Mean monthly rainfall at major locations is shown in the above figure. In the south and middle area, bi-model of rainfall pattern is prevailing in the southern and middle area, while a single rainy season is dominant in the northern area.

(3) Farming Practices for Irrigated Rice

1) Land Preparation

Land preparation starts at the beginning of rainy seasons. Plowing is practiced by tractor-drawn disc-plough after a few rainfalls. Extension workers of MOFA advise farmers to incorporate weeds into soils thoroughly. However, mechanical plowing is often less sufficiently done, resulting in weed infestation during the initial stage.

Plowing is followed twice at 7 to 10 days intervals by disc-harrowing with tractors. In the irrigation schemes, rotavation (paddling) is practiced after impounding with irrigation water. Hand tillers are prevalent in Ghana for rotavation aiming at softening soils for easy transplanting and weed control.

2) Transplanting

Transplanting is common in the irrigation schemes. Seedlings are grown in nurseries for 30 days and transplanted at the plant density of 22.2 hills per m^2 to 25 hills per m^2 with space of 30 cm x 15 cm to 20 cm x 20 cm.

3) Fertilization

Basal dosage is applied at 300 kg to 400 kg of the NPK compound fertilizer 15-15-15 per ha. Top-dressing is given with Sulfate Ammonium (N21%) at panicle formation stage of rice on 21st day after transplanting.

(4) Farming Practices for Rain-fed Rice

1) Land preparation

Transplanting is not prevailing for rain-fed rice, while direct sowing is commonly practiced. In the semi-humid central to southern zone, transplanting is practiced, although its extent is not known.

Plowing and harrowing are practiced by tractor-drawn disc-ploughs and disc-harrows. In the Northern region, bullocks-drawn ploughs are introduced for rice farming. Prevailing breeds are represented by West Africa Short Horn. Tractor hire services cost 380,000 cedi/ha for plowing, which can be reduced to 210,000 cedi/ha by animal traction. Hand tillers are also used for rain-fed rice.

2) Direct sowing / transplanting

Dry seeds are sown either in line or broadcasted at the beginning of the rainy seasons. In line planning, four or five seed grains are placed in holes, which are dug by dibbling, and covered by soils. Seeds are also broadcasted and mixed with top soils by mechanical harrowing. Seed rate is 80 kg/ha. Healthy germination and seedling establishment are encouraged by rainfalls after direct-sowing. Seeds in soils are sometimes damaged if rainfalls are delayed. Bird damage is

also common.

Transplanting is practiced to the limited extent. Poor leveling quality of paddy field makes on-farm water management more difficult. Seedlings also suffer from weed infestation if standing water is kept shallow in order to prevent damage of seedling from submergence.

3) Weed control

Weed control is crucial in direct sown paddy fields. Farmers do manual weeding in the first two months after sowing. Agricultural extension advises on the use of herbicides before and immediately after sowing. Common Herbicides used are Propanil and 2,4-D. Appropriate use of herbicides is important in terms of environmental conservation.

3.7 Current Situation of Rice Farmers

(1) Outline of Baseline Survey

Baseline survey was conducted to clarify the current situation on farmers' activities in five regions covering the Upper West, Northern, Ashanti, Western and Volta. The following sites were selected for the baseline survey.

Category -1: Some projects concerning rice development were already implemented, but there are no clear positive impacts due to some constraints.

Category -2: Currently some projects concerning rice development have been going on.

Category -3: There are no projects concerned, although paddy cultivation has been carried out in and around the site. So it is expected that paddy cultivation be accelerated and extended in the future.

Site locations for the baseline survey are shown in Figure 3.12, and outlines of the locations are given in Table 3.7.

Table 3.7 Outline of Baseline Survey Sites

1) Upper West region

Category	District	Community	Remarks
2	Jirapa Canbusie	Karni	Participatory Learning and Activities Research (WARDA, 2004-2006) was implemented.
3a	Wa	Sing	This site is categorized into lower rain-fed field. GIDA tried to construct water reservoir for irrigation, but the construction was halted.
3b	Nadowli	Daffiama	This site is categorized into lower rain-fed field. Farmers have some strong will for agricultural activities, and cultivated vegetables broadly.

Note: There is no location for site-1 in Upper West region. Therefore, a village with site-3 was selected additionally.

2) Northern region

Category	District	Community	Remarks
1	Savelugu/ Nanton	Dingoni	Lowland Rice Development Project (2001 - 2004) was conducted. Field bunds were constructed in order to keep flooded water in rainy season. However function for keeping water was lost due to low standard for facility construction and improper management for operation and

			maintenance.
2	Tolong /Kumbungu	Golinga	One of communities (villages) in the Golinga Irrigation Project of GIDA. There is a water reservoir, which was newly constructed. This reservoir has been used for supply of domestic water as well as irrigation.
3	Gushegu	Kpatili	This site is categorized into lower rain-fed field. Simple grain storage was broadly constructed and keeping goats has been disseminated, financing support by AfDB.

3) Ashanti region

Category	District	Community	Remarks
1	Ejisu Juaben	Nobewam	Community related with Anum Valley Irrigation Scheme of GIDA. Pump irrigation is functioned, but there are some constraints on its operation and maintenance.
2	Ahafo Ano North	Katabo	Location for Inland Valley Rice Development Project. Farmers carry out paddy cultivation in rain-fed fields intensively.
3	Adansi South (Adansi East)	Subriso	This site is categorized into lower rain-fed field. Farmers carry out paddy cultivation in rain-fed field intensively, using flooded water in rainy season.

4) Western region

Category	District	Community	Remarks
1	Nzema East	Kikam	Community related with Kikam Irrigation Scheme of GIDA. Paddy cultivation was halted since 1st year, due to pump trouble. Irrigation has been left without any operation currently.
2	Shama Ahanta East Metropolis	Kwabina Anokrom	Community for Inland Valley Rice Development Project Farmers carry out paddy cultivation in rain-fed field intensively.
3	Bibiani - Ahwiaso-Bekwai	Lineso	The area is categorized into lower rain-fed field. Farmers carry out paddy cultivation in rain-fed field intensively.

5) Volta region

Category	District	Community	Remarks
1	Ketu	Dekpor	Community related with Afife Irrigation Scheme of GIDA.
2	Hohoe	Akpafu Odomi	Credit scheme was supplied through Volta Regional Agricultural Development Project (1981 - 1982) and Gatsby Project under DfID (2004 – 2006). Rice mill was delivered through AgSSIP, but not used effectively.
3	Jasikan	Worawora	The area is categorized into lower rain-fed field.

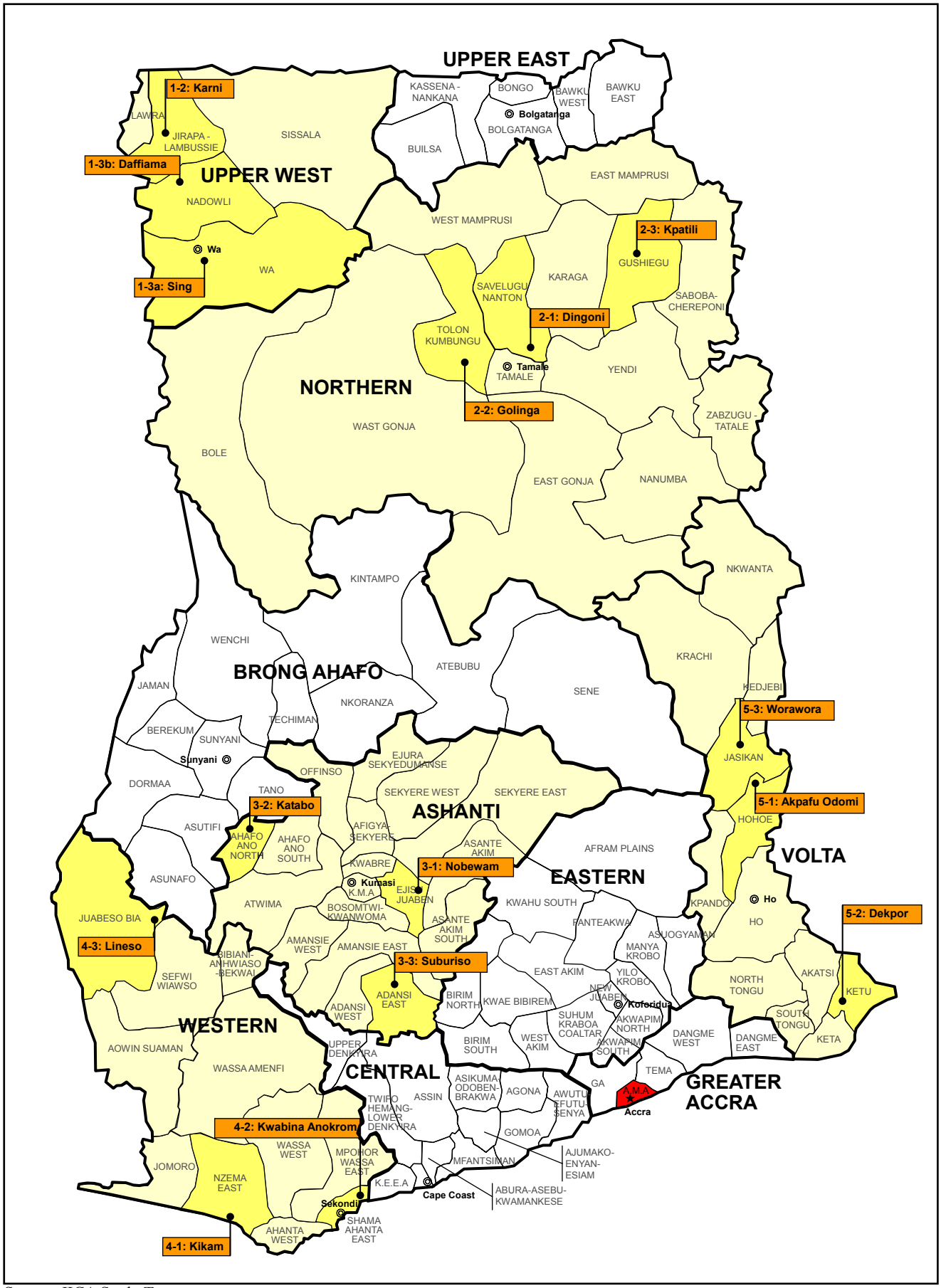
(2) Family Composition

Average family size in the survey area is estimated at around 10 persons and there is no regional variation. Furthermore, plural families with different generations stay in one compound together.

Table 3.8 Farmers' Family Size by Region

Region	Upper West	Northern	Ashanti	Western	Volta
Sample No.	42	44	42	44	45
Adult	4.9	6.6	5.0	2.8	7.7
Child	4.4	6.1	3.9	3.0	2.8
Total	9.3	12.7	8.9	5.8	10.5
No. of family	1.9	2.3	2.0	1.1	1.5
Generation	1.9	2.4	1.8	1.1	6.0

Adult：more than 19 years old、Child：less than 19 years old Source：Baseline survey (2006)、JICA Study Team



Source: JICA Study Team

Figure 3.12 Locations for Baseline Survey

(3) Management Scale of Typical Farmers and Cultivated Area by Crop

Holding size and cultivated area of typical farmers in the northern regions are relatively larger than those in southern regions. Cultivated rain-fed area in the northern regions is smaller than holding rain-fed area. This is caused by irregular rainfall conditions. Difference in cropping intensities in rain-fed lowland and upland fields is small. Some paddy cultivation areas are limited due to flooding and poor drainage conditions.

Table 3.9 Current Situation on Land Holding and Cultivated Farm Land by Region

Category / Area		Upper West Region	Northern Region	Ashanti Region	Western Region	Volta Region
Paddy field (irrigated)	Holding	-	0.20 ha	0.25 ha	-	0.35 ha
	Cultivated	-	0.19 ha	0.13 ha	-	0.31 ha
	(cultivated rate)	-	(95%)	(52%)	-	(89%)
Paddy field (rain-fed)	Holding	2.33 ha	2.79 ha	0.90 ha	0.87 ha	0.80 ha
	Cultivated	0.76 ha	1.14 ha	0.67 ha	0.44 ha	0.52 ha
	(cultivated rate)	(33%)	(41%)	(74%)	(51%)	(65%)
Upland field (rain-fed)	Holding	3.00 ha	5.07 ha	1.20 ha	1.60 ha	1.13 ha
	Cultivated	2.90 ha	3.19 ha	1.03 ha	0.93 ha	0.80 ha
	(cultivated rate)	(97%)	(63%)	(86%)	(58%)	(71%)
Tree crops field	Holding	-	-	0.59 ha	0.45 ha	0.48 ha
	Cultivated	-	-	0.59 ha	0.45 ha	0.37 ha
	(cultivated rate)	-	-	(100%)	(100%)	(77%)
Total	Holding	5.33 ha	8.06 ha	2.94 ha	2.77 ha	2.76 ha
	Cultivated	3.66 ha	4.52 ha	2.45 ha	1.78 ha	1.58 ha
	(cultivated rate)	(69%)	(56%)	(83%)	(64%)	(57%)

Source：Baseline survey(2006)、JICA Study Team

(4) Cultivated Crops and Cropping Pattern

In “low land” and “inland valley” area, paddy cultivation has been carried out under rain-fed condition in the rainy season. There is no cultivation of paddy and upland crops in the dry season.

In upland fields, upland crops such as maize, yam, cassava, millet, sorghum, and legumes are cultivated extensively. Present farming of paddy and upland crops is summarized in Table 3.10.

Table 3.10 Current Condition on Cultivation of Paddy and Upland Crops

1)Upper West region

Category-2：Karni	Category-3a：Sing	Category-3b：Daffiama
- Water Reservoir - Rainy season: Paddy cultivation under rain-fed condition in low land - Rainy season: Upland crops (ground nut: major cash crops in upland field - There is no paddy cultivation during dry season. Low land field is used for cattle grazing during the dry season. - Dry season: vegetables (onion, tomato, red pepper) under irrigation	- Paddy cultivation under rain-fed condition, but not so active - Vegetable (onion, tomato, etc.) cultivation in dry season - Utilization of well for irrigation - Maize and groundnuts, etc. are cultivated in rain-fed condition. - Paddy and yam: cash crops - Livestock: goat	- Water reservoir: no use for agriculture - Paddy cultivation under rain-fed condition is intensively done. - Womens’group cultivate paddy. - Vegetable cultivation during rainy season - Cowpea, millet, etc. in rain-fed upland field - Cash crops: paddy, ground nut

2)Northern region

Category-1 : Dingoni	Category-2 : Golinga	Category-3 : Kpatili
- Paddy is cultivated during rainy season in low land area (inland valley) - Upland crops such as ground nuts, maize, sorghum, millet, etc. are cultivated in rain-fed area.	- There is the reservoir. - Paddy cultivation in rainy season, while some farmers cultivate onion and other vegetables in dry season. - Double cropping of paddy is possible. But paddy cultivation in rainy and dry seasons is limited due to a shortage of rainfall.	- Paddy is mainly cultivated in rain-fed area. Cultivated area is not different depending on farmers. - Farmers have strong interests to cultivate upland crops. - Some womens' groups have activities concerning rice milling.

3)Ashanti region

Category-1 : Nobewam	Category-2 : Katabo	Category-3 : Subriso
- There is some pump irrigation facilities. - Irrigated area is limited due to a shortage of water. - Small scale of upland crops (maize, cereals, pepper, etc.)	- Paddy cultivation under rain fed prevails. Its cultivation is not stable, but farmers have strong interests in paddy. - Small scale of upland crops (maize, tomato, etc.)	- Paddy cultivation under rain-fed prevails. Its cultivation is not stable, but farmers have strong interests in paddy. - Small scale of upland crops (ground nut, maize, sorghum, millet, etc.)

4)Western region

Category-1 : Kikam	Category-2 : Kwabina Anokrom	Category-3 : Lineso
- No paddy cultivation due to pump trouble since 2nd cropping. - Paddy field has been left currently. - Paddy cultivation has been done surrounding area, but not so attractive. - Major crops are upland crops, not paddy. - Cash crops: vegetables, cassava - Major livestock: pig	- Paddy is mainly cultivated under rain-fed conditions. - Farmers' interests in upland crops is high, they cultivate extensively. - Brewing of sugarcane is popular.	- Paddy cultivation in rain-fed. Farmers' interests in paddy cultivation is high. But it unstable paddy cultivation due to shortage of water - Cultivation of upland crops is popular, but not stable due to shortage of rainfall

5)Volta region

Category-1 : Akpafu Odomi	Category-2 : Dekpor	Category-3 : Worawora
- Paddy cultivation under rain-fed condition.s. Farmers' high will on paddy cultivation - Supply of rice mill by AgSSIP - Farmers' interests in upland crops (cassava, maize, etc.)	- Irrigated paddy cultivation is popular. - Farmers' interests in upland crops (pepper, okra, cassava, maize, etc.)	- Paddy cultivation under rain-fed condition. Small scale cultivation - Farmers' interests in upland crops (pepper, okra, cassava, maize, etc.)

Source: Baseline survey (2006), JICA Study Team

Typical cropping pattern at each site clarified from the baseline survey (2006) is shown in Figure 3.13. Double cropping of paddy is carried out in Golinga (irrigated area) of the Northern region and Katabo area (rain-fed area) of the Ashanti region. While double cropping with paddy and maize is practiced in Dekpor of the Volta region.

The cultivated area is annually fluctuated, depending on climate condition. Cropping intensity in rain-fed area is estimated at around 100%. Double cropping of paddy – paddy or paddy – vegetables are practiced in the existing irrigated area such as the Golinga and Ashanti regions: Nobewam sites (GIDA schemes) and average cropping intensity is around 150%. This is because water source becomes shortage in the dry season for both Golinga area and Nobewan area, and pumps and tractors

can not be fully operated due to lack of operation fund. However paddy cultivation in the Volta region: Dekpor (GIDA Afife scheme) is one cropping in rainy season due to shortage of water.

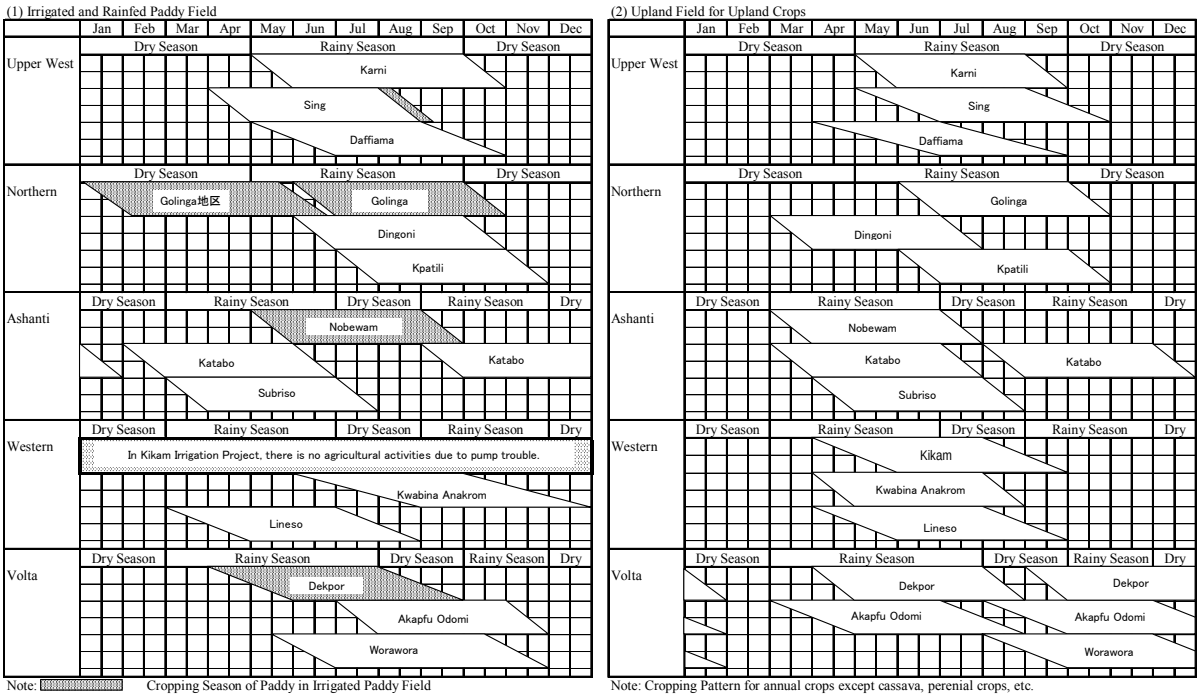


Figure 3.13 Typical Cropping Pattern

(5) Rice Varieties and Unit Yield

In Ghana, no systematic quality control of paddy varieties has been carried out without any attentions for quality seed renewal. Some rice development projects have carried out variety selection and seed production with farmers and distributed the certified seeds to project beneficiaries.

Varieties applied in each site are shown below. Around 30 varieties are cultivated at 15 sites in five regions. Due to limited information on name and characteristics of varieties, identification of varieties is difficult.

Table 3.11 Cultivated Varieties in Each Region

	Upper West	Northern	Ashanti	Western	Volta	Remarks
Miikpong	○					Improved varieties - Doubtful purification - Mainly multiplied by farmers
Digan, Tox	○	○				
Tox3108			○	○	○	
Bouake-189, WITA-7, Jasmine 85			○	○		
IET6279				○		
GR18		○				
Mandee		○	○			
Sikamo				○	○	
Grug 7, Marshall, IR5					○	
Nerica 1		○	○			
Brown Rice		○	○		○	Locally recommended varieties
Faro 15		○				
Afife		○				

	Upper West	Northern	Ashanti	Western	Volta	Remarks
Agona		○				
China			○			
Asanti Broni			○			
Ashanti Mmoo			○			
Viwornor					○	
Perfume					○	
Glaberima					○	
Local unspecified	○					- Others - Unspecified varieties
Local (Wala)	○					
Local white	○		○			
Local white (early)	○					
Local white (late)	○					

Source: Baseline survey conducted in 2006, JICA Study Team

Unit yield of paddy at each site is shown below. Unit yield is generally low except the Volta region and Kobina Anokrom and Lineso in the Western region.

Table 3.12 Unit Yield of Paddy

Region	Site	Rainy Season	Dry Season
Upper West	1. Karni	0.9 ton/ha	-
	2. Sing	1.0 ton/ha	-
	3. Daffiama	1.3 ton/ha	-
Northern	1. Golinga（irrigated area）	1.5 ton/ha	1.5 ton/ha
	2. Dingoni	1.5 ton/ha	-
	3. Kpatili	1.4 ton/ha	-
Ashanti	1. Nobewam（irrigated area）	1.8 ton/ha	-
	2. Katabo	1.1 ton/ha	1.1 ton/ha
	3. Subriso	1.3 ton/ha	-
Western	1. Kikam（irrigated area）	*	*
	2. Kwabina Anokrom	3.2 ton/ha	-
	3. Lineso	2.5 ton/ha	-
Volta	1. Akpafu	2.6 ton/ha	-
	2. Dekpor（irrigated area）	6.3 ton/ha	-
	3. Worawora	3.2 ton/ha	-

＊：Kikam Irrigation Project has no operation now. Source: Baseline survey (2006), JICA Study Team

(6) Farming Practices

Outline on farming practices in the baseline survey area is explained in Section 3.6 (3) and 3.6 (4) Characteristic points on farming practices clarified in the baseline survey are shown as follows:

Preparatory Work: In the Northern and Volta regions, tractors are broadly utilized for land preparation, while man-power is popular rather than tractor in the Ashanti and Western regions, and draft animals are rare. In the Upper West region, man-power and draft animals are popular, rather than tractors.

Sowing/Transplanting: Transplanting of paddy is very rare in the Upper West and Northern regions, while direct sowing under dry condition is popular. Further transplanting is broadly applied in other three regions. Initial growth after sowing / transplanting under rain-fed condition is relatively affected by climatic condition.

Application of Fertilizer: Basal dressing (100 to 200 kg of 15-15-15) and top-dressing (50kg of urea or ammonium sulphate) are applied in general. However effect of application

	of fertilizer on paddy growth is not clear due to unstable rainfall pattern as well as undulated land level.
Weeding:	Application of herbicide in the Upper West, Northern, and Western regions is not popular. Especially herbicide is scarcely applied in the Upper West region. Meanwhile herbicide is popular in the Ashanti and Volta regions.
Harvesting and Threshing:	Heading might not be even under rain-fed condition. Paddy grains, which harvesting is delayed, will be over-dried and thus broken easily. Furthermore post-harvesting losses will be increased.

Farmers in southern areas have more interests in paddy cultivation rather than ones in northern areas and constraints in southern areas are more practical and detailed as follows:

Table 3.13 Constraints on Paddy Cultivation

Subjects	Major Constraints	Remarks
Seeds	・No renewal of seeds in a long period ・No available certified seeds	・Common subjects in five regions
Fertilizer/ Agro-chemicals	・Shops for farm inputs are far ・Price of fertilzier/ agro-chemicals are higher.	・Common subjects in five regions, but these constraints are more secirous in the Upper West, Northern, and Ashanti regions
Farming Practice	・Shortage of man-power ・Difficult updating of cultivation right ・Increase of labour charge	・It is serious shortage of labour in Upper West, Ashanti, and Volta reiongs ・Insecured cultivation right and labour charge are common subjects in five regions.
Plant Protection	・Damage from bird ・Various pests and diseases	・Bird damage is common in five regions. ・Damages by pests and diseases are prevailed in Western and Volta regions
Post-harvestig Rice Milling	・Contamination of a lot of foreign matters in harvested paddy grains ・Unstable and late harvested timing ・Overdried grains	・Those constraints are common in five regions
Water Management	・Unstable rainfall pattern for rain-fed area ・Shortage of water in irrigated area	・Those constraints are common in five regions
Marketing	・Market for paddy sales is far. ・Price of paddy is low (during harvesting season) ・Beating-down of paddy	・Those constraints are common in five regions
Credit	・Late provision of loan against required time ・Procedure for loan application is complicated.	・Those constraints are common in five regions ・Borrowers are not so many.
Infrastructure	・Deterioration of irrigation facilities	-
Land issue	・Boundary of land holding is not clear.	-

Source: Baseline Survey (2006), JICA Study Team

(7) Farm Economy

Typical farm economy in the baseline survey is shown below. Farm income in the Western and Volta regions is higher than the Upper West and Northern regions. In the Upper West, Northern, and

Ashanti regions, paddy income is less than 50% of total agricultural income, and economic dependence on rice farming seems low. Annual income per family member ranges from US$120 to US$340. Income level in the northern areas is lower than one in the southern areas.

Table 3.14 Typical Farm Economy

Region	Upper West	Northern	Ashanti	Western	Volta
Cultivated Area (ha)	3.66 ha	4.52 ha	2.45 ha	1.97 ha	2.00 ha
Paddy（irrigated）	-	0.19 ha	0.13 ha	-	0.31 ha
Paddy（rain-fed）	0.76 ha	1.14 ha	0.67 ha	0.44 ha	0.52 ha
Upland crops	2.90 ha	3.19 ha	1.03 ha	0.93 ha	0.80 ha
Tree-crops	-	-	0.62 ha	0.60 ha	0.37 ha
1. Agricultural Income (unit : 1,000 cedi per annum)					
1.1 Paddy : irrigated	-	672 (5%)	825 (5%)	-	6,562 (29%)
1.2 Paddy : rain-fed	2,503 (23%)	4,133 (30%)	3,207 (20%)	2,792 (15%)	5,661 (25%)
1.3 Upland crops / tree crops	4,209 (38%)	2,582 (19%)	3,860 (24%)	6,481 (35%)	3,926 (17%)
1.4 Others	683 (6%)	1,379 (10%)	419 (3%)	1,266 (7%)	425 (2%)
Total (agricultural income)	7,395 (67%)	8,766 (65%)	8,311 (51%)	10,539 (57%)	16,574 (74%)
2. Non-agricultural Income	3,639 (33%)	4,805 (35%)	7,916 (49%)	7,778 (43%)	5,967 (26%)
3. Total Income	11,034	13,571	16,287	18,317	22,541
4. Total Expenditure	9,608 (87%)	12,694 (94%)	15,529 (95%)	16,410 (90%)	21,176 (94%)
5. Surplus	1,426 (13%)	877 (6%)	758 (5%)	1,811 (10%)	1,365 (6%)
6. Income per family member ($/person)	1,186 (US$130)	1,069 (US$120)	1,830 (US$200)	3,158 (US$340)	2,147 (US$230)

Source : Baseline Survey (2006), JICA Study Team

3.8 Types of Rice Farming Systems and Financial Analysis

(1) Grouping of Rice Farming System

Farmers in Ghana plant rice for both home consumption and income generation. With less use of farm inputs, rain-fed rice farmers in the northern areas of the country harvest only a limited amount of paddy grains for home consumption. A small quantity is sold to villagers and consumed locally. On the other hand, irrigation farmers in the GIDA schemes produce rice for cash income. To ensure sustainable rice farm management, appropriate farming technologies have to be carefully selected and introduced to meet needs and capacity of farmers. It is also important to optimize production targets for each of the farmers in order to reduce financial risks in rice farming by avoiding unnecessary investment.

The rice sector of Ghana has accumulated ample experience and lessons learnt for various development programs and projects for both irrigation and rain-fed rice cultivation. On the basis of all these experiences and lessons learnt, preparation of development standards for each typical rice farmers under both irrigation and rain-fed conditions shall be indispensable for rational development

in the rice sector of Ghana.

The Study preliminarily categorized rice farming systems of Ghana into three types taking into consideration the level of farming techniques and paddy yield. The planted area of rice is in general less than 1.0 ha per household. Large farmers are excluded since there are a few large-scale commercial farms for rice production in Ghana. Each of the typical rice farming systems of Ghana is characterized as presented below:

Table 3.15 Typical Rice Farming Systems of Ghana

	Type 1 Irrigated rice	Type 2 Semi-intensive rain-fed rice	Type 3 Low input rain-fed rice and upland rice
Purposes	Mainly for cash income	Cash income generation and home consumption	Mainly for home consumption
Present paddy yield	4.0～5.0 ton/ha	2.0～3.0 ton/ha	0.5～1.5 ton/ha
Target paddy yield	6.0 ton/ha and more	4.0 ton/ha	2.0 ton/ha
Water sources and irrigation facilities	Assisted by GIDA, irrigation facilities available for year-round irrigation farming	Rainfalls with supplemental water supply by diverting from small streams and springs	Only rainfalls
Land consolidation including bunds and land leveling	Bunds and land leveling acceptable for rice farming	Bunds and land leveling acceptable for rice farming	Bunds are not constructed and land leveling quality is poor.
Farming practices	Transplanting, mechanized farming practices, shortage of machinery hindering cropping system.	Direct seeding by dibbling, tractor hire services for land preparation or power tillers, manual harvesting manually.	Broadcasting, land preparation by either tractor or draft animals on demand.
Fertilizers and agro-chemicals	Basal dosage: 6 bags of NPK15-15-15 Top-dressing: SA 2bags (65 kg N/ha) Use of herbicide (Propanil)	Basal dosage: 6 bags of NPK15-15-15 Top-dressing: SA 2bags (65 kg N/ha) Use of herbicide (Propanil)	Rarely used
Agricultural credits	Utilized	Utilized	Not utilized or not accessible
Post-harvest	Processed at rice mills attached to the irrigation schemes	Processed by Engelberg or on-pass small rice mill	Pounding
Site visited	ICOUR (Tono, Vea) Upper East, Ashiaman	Vicinity of Kumasi and Tamale	Vicinity of Tamale

Source: Baseline survey (2006), JICA study team

Type 1 : Irrigated rice

Intensive rice cultivation is operated in the irrigation schemes developed by GIDA. Farmers can be provided with several government services including agricultural credits, tractor hire services, rice milling and market access. High production cost is one of the major constraints. Paddy yield improvement and quality control are required. (Photo: Tono Irrigation Scheme)

Type 2 : Semi-intensive rain-fed rice

Semi-intensive rain-fed rice farming is managed in the vicinity of urban centers such as Kumasi and Tamale. Paddy fields are developed on such low-lying land as inland valley bottoms. Supplemental water sources are often utilized. Yield level is as high as 4.0 ton/ha. Farmers are keen to access the market to generate cash by selling either paddy or rice. (Photo: SAWAH project in Kumasi)

Type 3 : Low input rain-fed rice and upland rice

Rice is cultivated under marginal agro-ecological conditions. Low input rice cultivation reduces financial risks though paddy yield as low as 1.5 ton/ha. Mixed cropping with other upland crops are observed. No bunds are constructed and land leveling quality is very low. (Photo: Tamale))

(2) Financial Analysis by Rice Farming System

Financial analysis of respective rice farming system, which was described in Section 3.8(1), was made using the results of the baseline survey and additional survey. Sites for baseline survey are categorized as follows:

Table 3.16 Grouping on Sites of Baseline Survey

Region	Type-1 Irrigated rice	Type-2 Semi-intensive rain-fed rice	Type-3 Low input rain-fed and upland rice
Upper West	-	Karni(Category-2)	Sing(Category-3a) Daffiama (Category-3b)
Northern	Golinga(Category-1)	Dingoni(Category-2)	Kpatili(Category-3)
Ashanti	Nobewam(Category-1)	Katabo(Category-2)	Subriso(Category-3)
Western	Kikam(Category-1)*	Kobina Anokrom (Category-3a) Lineso(Category-3b)	-
Volta	Dekpor(Category-1)	Akpafu Odomi (Category-2) Worawora(Category-3)	-

Note) *: Kikam is one of irrigation projects of GIDA. Irrigated paddy fields are left and no paddy cultivation has been done since 2nd cropping due to pump trouble.

1) Irrigated rice

The financial analysis of the irrigation farming system was made on the basis of data and information collected at Irrigation Company of Upper Region (ICOUR) in Navrongo of Upper East. ICOUR manages two irrigation schemes, namely Tono (2,032 ha) and Vea (850 ha). The total beneficiary farmers account for 4,000 to 6,000 households. The schemes were constructed in 1975 and have been managed under government control. In 1982, its management was transferred to ICOUR. Currently, 60% of the total management cost is covered by government budget, while the remaining 40% is by the project benefits. There are 182 management staffs whose salaries are fully paid by the government. Year-round irrigation is operated totally within 1,200 ha of both irrigation schemes to enable farmers to operate the double cropping a year. The average paddy yield is 4.0 ton/ha, and yields with 5.0 ton/ha to 6.0 ton/ha could be achieved by applying sufficient farm inputs.

Additionally, rice farming system in Dekpor of the Volta region is shown as a sample from the baseline survey. Dekpor is one of villages under GIDA Afife irrigation scheme, and the farmers have strong interests in paddy cultivation and high technologies. The cost-benefit analysis of irrigated rice is presented below:

Table 3.17 Cost-Benefit Analysis of Type 1 for Irrigated Rice

Description	Type 1-1 Irrigated Rice in ICOUR (High Yield)	Type 1-2 Irrigated Rice in ICOUR (Average Yield)	Type 1 Irrigated rice in Dekpor, through Baseline Survey
Gross Revenue (1000 cedi/ha)			
Paddy Yield (ton/ha)	6.0	4.0	6.3
Unit Price (cedi/kg)	2,200	2,200	2,976
Gross Revenue (1000 cedi/ha)	13,200	8,800	18,749

Description	Type 1-1 Irrigated Rice in ICOUR (High Yield)	Type 1-2 Irrigated Rice in ICOUR (Average Yield)	Type 1 Irrigated rice in Dekpor, through Baseline Survey
Production (1000 cedi/ha)			
Water Management	380 (4%)	380 (5%)	(-)
Plowing	500 (5%)	500 (7%)	1,500 (15%)
Harrowing	250 (3%)	250 (3%)	(-)
Land Leveling and Bund Repairing	300 (3%)	300 (4%)	(-)
Drainage Re-shaping	380 (4%)	380 (5%)	(-)
Rotorvation	780 (8%)	780 (10%)	(-)
Certified Seeds	500 (5%)	500 (7%)	536 (5%)
Fertilizer (NPK)	1,680 (17%)	1,050 (14%)	1,890 (19%)
Fertilizer (SA・Urea)	480 (5%)	320 (4%)	780 (8%)
Agro-chemicals	1,280 (13%)	615 (8%)	1,050 (10%)
Labour	1,880 (19%)	1,368 (18%)	3,760 (37%)
Others			600 (6%)
Other expenses (5%)	418 (4%)	320 (4%)	(-)
Sub-total	8,828 (89%)	6,763 (89%)	10,116
Bank commission	1,104 (11%)	845 (11%)	(-)
Total Cost (1000 cedi/ha)	9,932 (100%)	7,608 (100%)	10,116 (100%)
Revenue (1000 cedi/ha)	3,268	1,192	8,633
B/C (%)	25%	14%	46%

Source：Type 1-1 and 1-2: ICOUR - Cooperate Plan 2006-2010, Type 1: Baseline Survey (2006), JICA study Team

Farmers are organized into 27 cooperatives for procurement of farm inputs, and land preparation to harvesting is practiced by farm machinery of ICOUR. Farmers pay the service charges to ICOUR at the completion of harvesting. ICOUR operates the rice mill plant of the 1.0 ton/hour milling capacity and the steel silos of 2,000 ton storage capacity. Milled rice is purchased by wholesalers from Accra and Kumasi.

The unit production cost of irrigated rice is estimated at 9.9 cedi million per ha to harvest higher anticipated yield of 6.0 ton/ha. Out of the total cost, 35% is allocated to fertilizers and agro-chemicals, 22% is to land preparation and 19% to farm laborers. Because of gravity irrigation system, the water charge collected by ICOUR is only 4% of the total cost.

Most of farmers access credit from Agricultural Development Bank (ADB). The annual interest rate is 25%, which is another financial burden to farmers. The repayment period of the credit is six months. According to the interview to ADB, the recovery rate of agricultural credits for rice farmers is 75%. ADB points out that the rice farmers often fail to repay the credit in time due to difficulty in marketing.

2) Rain-fed rice

On the basis of the results of the baseline survey, the cost and benefit analysis of rain-fed rice farming was made as presented below. Concerning typical sites for Type 2 and Type 3, Akpafu Odomi (the Volta region) and Daffiama (the Upper West region) were selected from Table 3.16.

Table 3.18 Cost-Benefit Analysis of Types 2 and 3 for Rain-fed Rice

Description	Type 2		Type 3	
	Semi-intensive rain-fed rice (Akpafu Odomi)		Low input rain-fed rice and upland rice (Daffiama)	
Gross Revenue (1000 cedi/ha)				
Paddy Yield (ton/ha)	2.60		1.26	
Unit Price (cedi/kg)	2,850		2,857	
Gross Revenue (1000 cedi/ha)	7,410		3,600	
Production Cost (1000 cedi/ha)				
Land preparation	-		-	
Certified Seeds	350	(6%)	400	(14%)
Fertilizer (NPK)	1,000	(16%)	550	(19%)
Fertilizer (SA)	450	(7%)	-	
Agro-chemicals	895	(15%)	-	
Labour	3,230	(53%)	1,400	(48%)
Others	160	(3%)	560	(19%)
Total Cost (1000 cedi/ha)	6,085		2,910	
Revenue (1000 cedi/ha)	1,325		690	
B/C (%)	18%		19%	

Source：Baseline Survey (2006), JICA Study Team

Benefits in the above table are anticipated only in the average years. Due to largely fluctuating rainfall conditions, the benefits are not guaranteed in drought years. According to farm interviews in the Ashanti region, some farmers invest more farm inputs under rain-fed conditions. Stabilization of paddy yield is the utmost important issue for farmers to reduce the risks in farm management.

CHAPTER 4 POST HARVEST AND PROCESSING

4.1 Flow of Post Harvest of Rice in Ghana

The post harvesting of rice in Ghana consists of the following four processes:

i Harvesting, threshing and drying
ii Storage
iii Parboiling
iv Rice milling

(1) Harvesting, Threshing and Drying Process

In terms of work efficiency, combine harvesters are advantageous to manual slashing and threshing to complete harvesting practices within a right period. Therefore, combine harvesters have been widely used in the irrigated rice schemes of Ghana which is classified as "Rice farming system; type 1 (Irrigated rice)".

In recent years, the number of combine harvesters has been sharply decreased. Due to large procurement costs and high running costs, the number of combine harvesters has been decreasing without replacement since the Structure Adjustment Policy was initiated. Also, it is difficult to operate combine harvester in small parcels of farmland where development of farmland and access road has not be made.

As an alternative for combine harvesters, reapers have been broadly introduced and replaced with combine harvesters. It is expected that use of reapers will be more common in Ghana to compensate for the shortage of combine harvesters. The main reasons of increase of reapers are as follows;

-1. Low procurement cost
-2. Can be operated relatively in small area farmland
-3. Reapers can pass through narrow and sharply inclined road to farmland

The decreasing number of combine harvesters simultaneously reduces the threshing capacity. In recent years, utilization of power threshers has been started. Power threshers are operated on farmland or public drying yard as the need arises. The historical number of farm machinery is as follows;

Table 4.1 Comparison of Number of Farm Machinery between 1980s and 2002

Farm Machinery	Operated numbers in the latter half of 1980th	Operational numbers in 2002
Combine harvesters	200	21
Reapers	120	200
Power threshers	none	90

Source: Special Task Force Report on Strategies for Improving the Rice Industry in Ghana, Ministry of Food and Agriculture, April 2003.

As shown in the above, most of harvesting and threshing works are not mechanized and are done by human power. Slashing position of paddy at harvesting period differs from threshing methods. In

case panicles are stacked on the floor and threshed by beating of bar, panicles are cut about 40cm upper part from the ground level. On the other hand, in case panicles are beaten to the wooden box or oil drum to thresh, panicles are cut near ground level. Most of paddy under “Rice farming system; type 2 (Semi-intensive rain-fed rice) and type 3 (Low input rain-fed rice and upland rice)” explained in Chapter 3 is harvested manually.

Drying and threshing work done on the concrete floor ensures the prevention of processing losses and mixture of impurities. In case a concrete floor is not available, threshing work is done on tarpaulin sheets as much as possible to prevent losses and mixture of impurities.

The biggest influential factor on the quality of milled rice is the quality of paddy. If the quality of paddy is low, the quality of milled rice would go off no mater how-better rice milling plant perform. Following points are important to ensure high quality. Moisture control of paddy and milled rice is a critical factor;

-1. To ensure high quality paddy, harvesting and threshing shall be done at appropriate time.
-2. To carry out appropriate drying of harvested paddy when its moisture content is high.
-3. To avoid grain cracking caused by excessive drying, which usually happen under abnormal weather conditions such as high temperature and low humidity.
-4. To keep appropriate moisture content of paddy during storage.

Paddy harvested by reapers or human power is generally sun-dried either on farm or on public drying yard. Use of mechanical heat-powered dryer is ideal but not recommended due to high cost implication. The drying process is often disturbed by unfavorable weather conditions. Under cloudy or rainy weather conditions, grains are deteriorated due to high moisture and colored grains arisen from malt and bacteria in semi-humid areas in the southern country.

On the other hand, the harvesting time falls in the dry seasons in middle and northern country and them atmospheric temperature rises up and humidity drops down. Therefore, the moisture content of panicles left on farm decreases within a few hours down to 10% and below against 14% of optimum moisture content.

Drying of paddy under direct sun shine results in cracked grains. Cracks are caused by unequal moisture distribution in endosperm since grain surface is dried faster than its center part. Needless to say, cracked grains will increase higher broken rice ratio.

Usually harvested and dried paddy is kept by farmers, however some of them are purchased by the middleman at the farm gate.

Processes involved in harvesting, drying and threshing at the farm are as follows:.

Cutting at ground level and threshing

(1) Panicles cut at near ground level are dried on the sheet. Adujyaya, Ashanti Region

(2) Dried panicles are beaten to the oil drum on the sheet, to remove paddy. Adujyaya, Ashanti Region

Cutting at upper part of panicle and threshing

(1) Harvesting work. Panicles are cut about 40cm upper part from the grand level. Navrongo, Upper East Region.

(2) Threshing work at public concrete yard. Stacked panicles are beat by stick. Navrongo, Upper East Region.

(2) Storage Process

Though some of the dried paddy is purchased by traders such as Market Mammy at drying yard or farm gate, most of the paddy is kept by each farmer till milling or selling time. Paddy grains are normally stored by individual farmers. Paddy is put into plastic or jute bags with a capacity of 80 to 85kg. These bags are piled up in storage facilities with an earthen floor.

(3) Parboiling Process

In Ghana, especially in the central and northern areas, parboiling is a popular processing practices. The process is; firstly paddy is soaked in the water, secondly steamed, and thirdly paddy is dried before the milling process. Parboiled paddy is milled same as ordinary paddy.

As mentioned above, in the middle and northern areas, paddy grains exposed under direct sunshine and low humidity and cracked easily. Paddy grains with cracks easily become broken rice through rice milling process, and also milling recovery ratio is increased.

The main reason why the parboiling process has been done in this country is that some part of the

cracks on the grains is recovered during parboiling process. The need for parboiling depends on the degree of paddy moisture content for milling.

In the northern areas, paddy may not be parboiled in the irrigated areas with well managed post-harvest processing because moisture content of harvested paddy may not be excessively decreased. On the other hand, paddy produced in rain-fed or upland area of the northern areas might be excessively dried due to insufficient control of post harvest processing. The parboiling process is not made in the southern areas due to no excessive drying problem.

Some parboiled rice is sold as special rice by traders of USA, India, Pakistan and Thailand because of its flavor. However, the major reason of parboiling in Ghana is to decrease the broken rice ratio.

Parboiling is usually made by women groups living near rice mills to get processing fees from farmers or traders. Research and extension activities for simple parboiling process are implemented as shown below at Rural Agricultural Development Unit (RADU), Ministry of Food and Agriculture in Tamale, the Northern region.

Soaked paddy is steamed in big pot.

After completion of the steaming, parboiled paddy is dried on the concrete floor.

(4) Rice Milling Process

Most of rice milling in Ghana is made on contract (or custom) bases. Millers get milling charge in reward for their rice processing work. Paddy is brought to rice mills by farmers or brokers, and processed by rice millers. Rice millers get appropriate milling charges from farmers or brokers. Revenues from rice milling are the milling charges and income from by-products sale such as rice bran, husk and fine broken rice, etc. Income from by-products sales belongs to client or millers, or divided by client and millers depending on locality. Sharing of by-products sales differs by local custom of the areas.

In the case rice millers purchase paddy from producers and sell to brokers or retailers after milling, they may get more profit (profit from rice processing fee + profit from the distribution and marketing fee) than income only from custom milling. However rice millers usually do not purchase paddy at present. The major reason for this situation is a shortage of working capital for purchase of paddy.

Most of paddy transactions between farmers and consumers are conducted by traders, and some of

them are usually financed by banks amply. Major rice traders usually deal both domestic and imported rice. Their handling amount of imported rice is larger than the amount of domestic rice.

4.2 Reviews of the Present Situation of Post Harvest through the Baseline Survey

A baseline survey has been conducted in 5 regions. From each region, 3 communities were selected. From each community, about 15 households were selected and interviewed. The total number of surveyed households was 214 and average paddy production area was 0.63 ha. As regard to paddy production area, the average area was 137% in the Northern region and its 76% was in the Volta region.

Details of the studied area are shown in the Table 4.2 as follows.

Table 4.2 Details of the Studied Area by the Baseline Survey

Name of Region	Name of Community	Q'ty of the Household		Average Cultivated Area (ha/Household)	
		Total in Community	Total in Region	Average in Community	Average in Region
1. Western	Kikam	14	44	0.51	0.56 (89%)
	Kwabina A.	15		0.63	
	Lineso	15		0.53	
2. Volta	Akpafu	15	45	0.43	0.48 (76%)
	Dekpor	15		0.49	
	Worawora	15		0.53	
3. Ashanti	Nobewam	15	41	0.37	0.63 (100%)
	Kotabo	11		0.53	
	Subriso	15		0.98	
4. Northern	Golinga	14	42	0.95	0.86 (137%)
	Dingoni	15		0.56	
	Kpatili	13		1.12	
5. Upper West	Karni	12	42	0.50	0.65 (per Average103%)
	Daffiama	15		0.87	
	Sing	15		0.54	
		Total Household	214	Average	0.63

Source: Baseline Survey 2006, JICA Study Team

(1) Present Situation of Harvesting Work done by Farmers

As a result of the survey, it was realized that harvesting and threshing work could be classified into the following 3 categories.

-1. Farmers harvest and thresh their paddy by themselves.
-2. Harvesting and threshing works are done by cooperative labour in the community without payment.
-3. Farmers employ contractors for custom harvesting and threshing .

By the survey, it was noted that most farmers in the northern areas have done the harvesting work by them selves. On the other hand, the farmers in the central and southern areas usually employ contractors for harvesting.

Harvesting charge in the Northern region is extremely low. This may be due to the limited number of farmers who employ contractors and collected data maybe inclined. Harvesting charge in the Northern region becomes small due to its average harvesting area is larger than other regions. Average charge

for contract harvesting accounts for around 630,000 ¢/ha as following Table 4.3.

Table 4.3 Present Situation of Harvesting Work

Region	Average Harvested Area (ha/ Household)	Ratio of Working Type (%)			
		By Farmers themselves	Joint Works (Labor Exchange)	Contract Harvesting	
					Average Charge (cedi/ha)
1. Western	0.56	27%	11%	61%	658,000
2. Volta	0.48	33%	0%	73%	677,000
3. Ashanti	0.63	34%	10%	51%	679,000
4. Northern	0.86	86%	5%	12%	230,000
5. Upper West	0.65	69%	7%	33%	559,000
Total	0.63	50%	7%	47%	633,000

Source: Baseline Survey 2006, JICA Study Team
Note: 1. Since farmers may apply more than one type of labour for harvesting, total ratio may be more than 100%.
2. Harvesting charge is rounded off to three-digit number.

(2) Present Situation of Threshing Work done by Farmers

Threshing work is also carried out by three type of working modes, namely, 1) work by farmers by themselves, 2) collective work without payment under the community custom like traditional labor change, and 3) contract work by the third party. Although harvesting work is made by farmers themselves and contract works in the same proportion, threshing work tends to be carried our by farmers themselves. Particularly in the northern area, majority of farm households conduct threshing by themselves, accordingly contract charge is lowest among the regions.

Table 4.4 Present Situation of Threshing Work

Region	Average Harvested Area (ha/ Household)	Ratio of Working Type (%)			
		By Farmers themselves	Joint Works (Labor Exchange)	Contract Threshing	
					Average Charge (cedi/ha)
1. Western	0.56	41%	9%	48%	526,000
2. Volta	0.47	38%	0%	69%	525,000
3. Ashanti	0.69	54%	7%	37%	594,000
4. Northern	0.89	86%	0%	12%	300,000
5. Upper West	0.65	86%	5%	17%	554,000
Total	0.65	61%	4%	37%	547,000

Source: Baseline Survey 2006, JICA Study Team
Note: 1. Since farmers may apply more than one type of labour for threshing, total ratio may be more than 100%.
2. Threshing charge is rounded off to three-digit number.

(3) Present Situation of Drying Work done by Farmers

Most of households dry the paddy by themselves. Drying works by type and their share are as follows:

Table 4.5 Present Situation of Drying Work

Region	Average Harvested Area (ha/ Household)	Ratio of Working Type (%)		
		By Farmers themselves	Joint Works (Labor Exchange)	Contract Drying
1. Western	0.56	100%	0%	0%
2. Volta	0.48	89%	0%	11%
3. Ashanti	0.63	100%	0%	0%
4. Northern	0.86	98%	5%	2%
5. Upper West	0.65	100%	0%	0%
Total	0.63	97%	1%	3%

Source: Baseline Survey 2006, JICA Study Team
Note: 1. Since farmers may apply more than one type of labour for drying, total ratio may be more than 100%.

(4) Present Situation of Storage done by Farmers

Most of all households dry the paddy by themselves and keep in the bags. The following are typical storage methods done by farmers, and their ratio are shown in Table 4.6.

-1. Filling paddy in jute bags and store in warehouse, etc.
-2. Filling paddy in plastic bags and store in warehouse, etc.
-3. Filling paddy in recycled plastic bags, as fertilizer bag, and store in warehouse, etc.
-4. Using silos, etc.

Other than the in-bag paddy distribution, bulk handling of paddy is also considerable. However in order to realize bulk handling, exclusive vehicles and/or bulk containers, etc. are necessary and also those vehicles shall be able to access drying and threshing yard near the farm land. One of the important conditions for bulk handling of paddy is easy collection at a certain point. Due to poor infrastructural development such as access roads and high cost for bulk handling vehicles and containers , bulk handling of paddy is quite expensive and not realistic. Grain silos are rarely used in Ghana even though there are some silos attached to rice mill plants.

Table 4.6 Present Situation of Paddy Storage by Farmers (Sep.-Oct., 2006)

Region	In jute bag	In plastic bag	In recycled bag (mainly fertilizer bag)	In silos / others
1. Western	32%	2%	57%	9%
2. Volta	9%	2%	56%	33%
3. Ashanti	78%	10%	12%	0%
4. Northern	90%	7%	0%	7%
5. Upper West	64%	2%	31%	2%
Total	54%	5%	32%	11%

Source: Baseline Survey 2006, JICA Study Team
Note: Since farmers may use more than one type of storage facilities, total ratio may be more than 100%.

(5) Present Situation of Rice Milling of Farmers

Present situation of rice milling activities of farmers is shown as following Table 4.7.

Table 4.7 Present Situation of Rice Milling

Region	Average Harvested Area (ha/ Household)	Ratio of Working Type (%)			
		By Farmers themselves	Farmers sell their paddy	Contract Milling	
					Average Charge (cedi/kg-paddy)
1. Western	0.56	30%	0%	70%	358
2. Volta	0.48	29%	0%	71%	347
3. Ashanti	0.63	0%	0%	100%	324
4. Northern	0.86	45%	0%	55%	201
5. Upper West	0.65	74%	7%	19%	246
Total	0.63	36%	1%	63%	306

Source: Baseline Survey 2006, JICA Study Team
Note: Since farmers may apply more than one type of milling, total ratio may be more than 100%.

About 75% of farmers interviewed in the Upper West region and 45% in the Northern region are milling by themselves. On the other hand, 100% in the Ashanti region and more than 70% of in the Western region and the Volta region are milling at rice mills on commission basis. The same as for other charges, milling charges are also at a low level in the Northern region compared with other regions.

(6) Operation condition of Small Scale Rice Mills through the Baseline Survey

Target rice millers were selected from area of rice production villages for the baseline survey. Basically, 3 millers were sampled from each target area. Milling charges of surveyed millers are shown as follows:

All rice millers in the Upper West region and the Northern region under the survey were using Engelberg type rice milling machine, while 60% to 90% of millers are using One-Pass type rice milling machine in other three regions in the central and southern areas. Some millers using One-Pass type including paddy cleaner, sieves or grader, etc. in the Volta region. In all five regions, 46% of millers are using Engelberg type and 54% of millers are using One-Pass type. Also milling charge in the Northern region is cheaper than other areas. Milling charge of Engelberg type is about 75% of One-Pass type. Details are shown in the following Table 4.8.

Table 4.8 Milling Charge of Small Rice Millers (Sep.-Oct., 2006)

Region	Engelberg Type			One-pass Type			Total	
	Q'ty	Ratio	Charge	Q'ty	Ratio	Charge	Q'ty	Charge
1. Western	3	38%	412	5	63%	357	8	414
2. Volta	2	22%	357	7	78%	367	9	369
3. Ashanti	1	11%	542	8	89%	383	9	449
4. Northern	8	100%	177	0	0%	-	8	177
5. Upper West	3	100%	275	0	0%	-	3	275
Total	17	46%	278	20	54%	371	37	328

Source: Baseline Survey 2006, JICA Study Team
Note: Unit of the "Charge" in the Table is cedi/kg on paddy

(7) Results of the rice sample analysis purchased in the local market through the Baseline Survey

Through the baseline survey, milled rice samples were purchased in the local markets of the five target regions. 92 domestic samples and 55 imported samples were analyzed based on the Ghana Standard (Details of the standard are mentioned below), and the results are shown in above Table 4.9.

Table 4.9 Analysis Result of Milled Rice purchased in the Local Market

Sampling Area		Q'ty of sample	Retail Price	Moisture Contents	Grade	Grain Length	Grain Width	Broken Grain				Chalky Grain	Foreign Matters	Red Grain	Discolored Grain
								Total	Large Broken	Medium Broken	Small Broken				
			cedi/ kg	% w.b.		mm		Mixture ratio (%)							
Domestic Rice	Accra/Tema	28	6,827	13.1	4.5	6.9	2.4	44.2	10.6	15.9	17.7	3.8	0.2	11.0	1.7
	Ashanti	15	2,867	13.3	4.9	6.8	2.5	58.2	12.5	18.6	27.1	4.9	1.0	13.8	1.1
	Western	9	3,000	14.2	4.8	6.9	2.7	59.6	8.9	10.8	40.0	0.8	-	0.4	0.1
	Northern	7	2,571	14.3	4.7	6.8	2.4	36.8	6.6	9.6	20.5	0.3	0.1	0.1	1.3
	Upper West	10	3,000	15.3	4.4	6.8	2.4	35.9	7.6	10.7	17.6	0.8	0.2	0.1	2.8
	Volta	16	6,888	12.8	4.8	6.8	2.4	65.4	9.2	15.2	41.0	4.7	-	6.5	1.7
	Tamale	7	2,714	14.3	4.7	6.9	2.4	40.4	12.3	14.5	13.6	1.6	-	0.3	0.9
	Sub Total	92	4,719	13.6	4.7	6.8	2.4	49.9	10.0	14.6	25.3	3.1	0.2	6.8	1.5
Imported Rice	Accra	15	7,393	12.7	2.9	7.0	2.1	25.5	6.4	5.9	13.1	2.9	-	0.0	0.3
	Ashanti	15	6,613	12.9	2.8	6.7	2.0	31.1	7.4	8.2	12.1	3.0	0.0	-	0.4
	Western	9	5,728	12.7	2.2	6.8	2.1	19.8	3.9	4.0	11.9	1.0	-	-	0.1
	Northern	10	6,620	12.6	3.2	6.9	2.2	30.1	5.9	6.8	17.3	3.9	-	-	1.2
	Upper West	6	7,033	13.2	2.8	6.8	2.1	17.0	3.9	4.1	9.1	2.9	0.1	-	0.6
	Sub Total	55	6,728	12.8	2.8	6.9	2.1	26.0	5.9	6.2	13.0	2.8	0.0	0.0	0.5
Total		147	5,481	13.3	4.0	6.8	2.3	41.0	8.5	11.4	20.7	3.0	0.2	4.3	1.1

Source: Baseline Survey 2006, JICA Study Team

-1. Average price of domestic milled rice is only 70% of imported rice.

-2. Average moisture content of domestic rice is measured as 13.6%, which exceeds the upper limit of the Ghana Standard (13.5%). Since the storage under high temperature and humidity easily causes deterioration, it is necessary to make the moisture content of domestic milled rice below 12.5%. On the other hand, the average moisture content of imported rice is almost as much as 12.8%. Since domestic rice must compete with imported rice in quality, more serious quality control for domestic rice is strongly required.

-3. Grade is the result of the analysis based on the Ghana Standard. The smaller value the indicates higher quality. The average grade of domestic rice is 4.7, while the one of imported rice is 2.8, grades of both categories of rice show big different.

The largest cause that makes the grade of domestic rice low is the high rates of broken rice. In order to prevent the generation of broken rice, a superintendence of moisture content from the paddy field to the rice milling processing is required. Even if broken rice is generated, it can be eliminated by the length grader and whole grain with high commercial value can be obtained. Since some investment is required in order to produce high quality and high price rice, a proper financial system should be

established.

The grade distribution of domestic and imported rice is shown in Table 4.10, and the length distribution of domestic and imported rice is shown in Table 4.11. In spite of more than 50% of imported rice is grade 1 or 2, more than 80% of domestic rice is grade 5 which is the lowest grade of the quality.

By an analysis of the length, it is confirmed that the majority of the rice in Ghana is long grain.

Table 4.10 Grade Distribution of Domestic and Imported Rice

Grade	1	2	3	4	5	N.A.
	High grade <<< >>> Low grade					
Domestic Rice	0.0%	4.3%	6.5%	5.4%	82.6%	1.1%
Imported Rice	5.5%	50.9%	16.4%	10.9%	16.4%	0.0%

Source: Baseline Survey 2006, JICA Study Team

Analysis standard: Standard for Classification: Cereals, Pulses and Legumes - Specification for Rice. GS 765: 3003, Ghana Standard Board

Table 4.11 Length Distribution of Domestic and Imported Rice

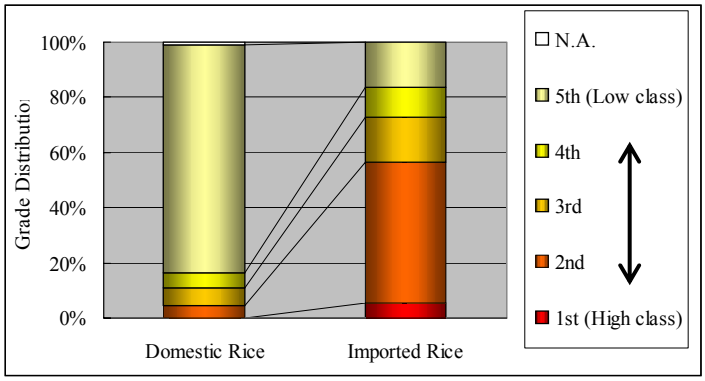
Length	L (≥6.6mm)	M (6.6 - 6.2mm)	S (6.2mm>)
Domestic Rice	83.0%	3.8%	13.2%
Imported Rice	65.2%	31.5%	3.3%

Source: Baseline Survey 2006, JICA Study Team

Analysis standard: Standard for Classification: Cereals, Pulses and Legumes - Specification for Rice. GS 765: 3003, Ghana Standard Board

Figure 4.1 shows the grade distribution of domestic and imported rice. This figure shows the difference of the quality of both kinds of rice clearly.

Figure 4.2 shows the relation between grade and retail price of milled rice. Some trend shown by the arrow in the figure can be confirmed regarding the imported rice. However no trend can be found between the grade and retail price of domestic rice.



Source: Baseline Survey 2006, JICA Study Team

Figure 4.1 Grade Distribution of Domestic and Imported Rice

Figure 4.3 shows the relation between broken rice ration and retail price of milled rice. The same as in the above figure 4.2, no definite trend can be confirmed.

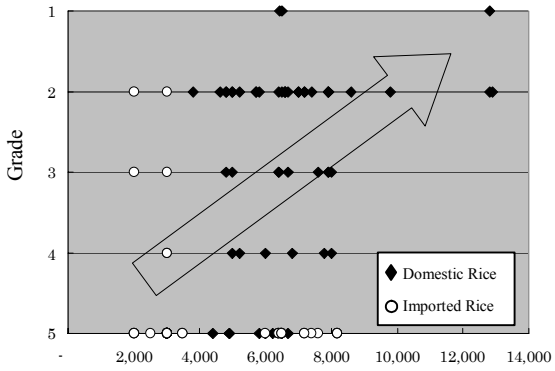


Figure 4.2 Relation between Grade and Retail Price of Milled Rice

Source: Baseline Survey 2006, JICA Study Team

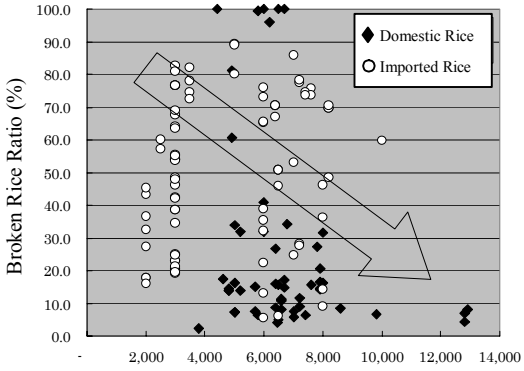


Figure 4.3 Relation between Broken Rice Ratio and Retail Price of Milled Rice

Source: Baseline Survey 2006, JICA Study Team

Table 4.12 shows the relation between length of milled rice and retail price. No trend can be found for either domestic rice or imported rice.

Table 4.12 Relation between Length of Milled Rice and Retail Price

(unite: cedi/kg-milled rice)

	Large (≥6.6mm)	Medium (6.6- 6.2mm)	Small (6.2mm>)	Average
Domestic Rice	5,028	4,003	5,667	4,719
Imported Rice	6,953	4,900	5,772	6,728

Source: Baseline Survey 2006, JICA Study Team

The following Table 4.13 shows the extracts of the regulation of the grade of milled rice by Ghana Standard Board.

Table 4.13 Grade of Milled Rice by Ghana Standard Board (Extracts)

Grade and Grade requirements for Long, Medium and Short Grain Milled Rice

Grade	Permissible limits of fractions and other extraneous matter											
	Broken %			Chalky %			Contamination Ratio (% in weight)					
	Long Grain	Medium Grain	Short Grain	Long Grain	Medium Grain	Short Grain	Foreign Matter	Red Grain	Insect Damaged Grain	Discolored Grains	Presence of insects / insect parts	Admixture
1	5.0	5.0	5.0	2.0	5.0	5.0	0.6	Nil	0.5	Nil	Nil	2.0
2	15.0	10.0	10.0	5.0	8.0	8.0	0.6	Nil	0.5	Nil	Nil	2.0
3	25.0	20.0	20.0	10.0	10.0	10.0	1.0	Nil	0.5	Nil	Nil	4.0
4	30.0	25.0	25.0	15.0	15.0	15.0	1.0	0.5	1.0	1.0	Nil	20.0
5	35.0	30.0	30.0	15.0	15.0	15.0	1.0	0.5	1.0	1.0	Nil	20.0
Moisture contents: 13.5% or less wet bases Long grain rice: Kernel length of 6.6mm or more Medium grain rice: Kernel length of 6.2mm or more but less than 6.6mm. Short grain rice: Kernel length of less than 6.2mm.												

Source: Standard for Classification: Cereals, Pulses and Legumes - Specification for Rice. GS 765: 3003, Ghana Standard Board

4.3 Present Situation of Modern Rice Milling Plant

At present, a large volume of unified quality paddy could be produced only under irrigated paddy area.

(1) Direct Interview Survey for Irrigated Area and Modern Rice Milling Plant

Study team members visited typical irrigated areas and modern rice mills to investigate present situations and constraints. For area selection for the survey, the team referred the data from Irrigation Development Center (IDC). Outline of each project or facility are in Table 4.14.

Table 4.14 Summary of Direct Interview Survey for Irrigation Projects and Modern Rice Mills

Name of Project / Rice Mill	Rice Production Area	Paddy Production	Rice Processing
1. Kpong Irrigation Project	2,000 ha	10,000 ton (Rainy season only)	About 70% of paddy is processed by Aveyime Rice Mill. Milling Charge: 221 cedi/kg-paddy About 30% of paddy is processed by small scale rice mills situated around production area. Milling Charge: 120 cedi/kg-paddy by electric motor mill 144 cedi/kg paddy by diesel engine mill
2. Aveyime Rice Mill	・ Quality Grain Company was established in 1998 by an American investor. Activities were to include not only rice mills but also the management of paddy production farms. ・ At present, the mill is managed by a committee which is headed by the Deputy Chief Executive (Agronomy), GIDA. ・ The mill has a maximum paddy processing capacity of 1010 tons per hour, which is the biggest capacity in Ghana. ・ Greater share of paddy produced from Kpong and Afife are processed at the Aveyime Rice Mills. ・ Big time rice traders such as Remmah Rice and Mrs. Opoku secure their paddy exclusively at their warehouse.		
3. Ashaiman Irrigation Project	15 ha	41ton (Rainy season only)	About 80% of paddy is processed by the Rice Mill owned by Irrigation Development Center (IDC), GIDA, which was installed through the Japanese Grant Aid. Milling Charge 143 cedi/kg-paddy
4. Nasia Rice Mill	・ Nasia Rice Co., Ltd. was established in 1973. ・ Rice Mill was installed in 1977 through funding from the African Development Bank. The rice mill is presently controlled by four financial institutions. ・ Up to 1998, the Company was operating on a maximum of 240ha of paddy fields, and also post harvest processing of paddy all by using their own agricultural machinery. ・ From 1998, the Company exclusively worked in the area of post harvesting processing including parboiling of paddy. ・ At present, the milling and parboiling facilities have paused. Charges for reference are as follows, ・ Milling Charge: 241 cedi/kg-paddy Straight milling (rice milling only) 645 cedi/kg-paddy Parboiling and Rice milling		
5. Tono Irrigation Project	1,090 ha	3,800ton (Rainy and Dry season)	5-10% of paddy produced at Tono is processed by ICOUR Rice Mill Milling Charge: 212 cedi/kg-pady 90-95% of paddy remaining is sold at the local market. ・ Some amount of rice produced is distributed through GATSBY (NGO) or SARI. ・ Previously some of the paddy produced here had been processed by Nasia Rice Mill. ・ ICOUR Rice Mill was funded by Japanese Grant Aid.
6. Afife Irrigation Project	880 ha	4,400ton (Rainy season only)	About 70% of paddy is sold out to other areas as paddy, through big rice traders such as Remma or Mrs. Opoku or traders in Kumasi. Price: 2,860 cedi/kg-paddy About 30% of paddy is processed by small scale rice mill in production area.

Source: 1. Baseline Survey 2006, JICA Study Team
2. Direct Interview Survey 2006-2007, JICA Study Team

(2) The problems of modern rice mills

Both Aveyime rice mill in the Volta region and Nasia rice mill in the Northern region are the most modern rice mills with high processing capacity in Ghana. However, unfortunately, both rice mills are processing very few volume of rice compared with their designed (estimated) capacities. The following are the reasons for these problems.

-1. Designed hourly processing capacity of Aveyime rice mill is 10 tonnes on paddy and Nasia rice mill is 4 tonnes. Both mills only can perform their designed processing capacities only when the material paddy of designed volume are provided and processed continuously. (For example, hourly capacity of Aveyime is 10 tonnes, and this mill can not process 5 tonnes of paddy continuously in one hour) Without providing enough volume of material paddy, the mill should be operated intermittently and continuous operation is impossible.

-2. Before the structural reforms, rice traders could get finance for procurement of paddy from the Government, and they purchase a lot of paddy and commission this process to large scale millers for processing.

However, after structural reforms, most traders could not have enough procurement funds and they could not procure a large quantity of paddy at one time. Even if a large quantity paddy of the same quality was available, they should be bought by a small lot. In order to ensure full performance of the mill, sufficient volume of paddy needs to be procured. However, because of the above situation, only a small lot of paddy is brought at a time. Some modern rice mills can not process such small lots of paddy, and are being under utilized. The material paddy which was processed into high quality milled rice before, is now processed by small scale mills, and the quality of the final products (milled rice) might be lower than before. The competitiveness of such local milled rice against imported rice must be declined compared with before. Actually, Nasia rice mill is shut down at present.

-3. Aveyime rice mill was jointly established by the Government of Ghana and some American private sector. However, the American private sector withdrew from the management, and the present actual processing volume is much lower than its original capacity.

-4. Although both rice mills have facilities to dry paddy and huge silos to store paddy, they are not used because it is common that paddy is put into bags while it is transported and stored. Therefore, it could be concluded huge loss of cost occurred.

(3) Issues to be considered when rice mills will be newly planned

In reference to the above mentioned problems, the following issues should be considered when new rice mills are planned.

-1. Even if the total processing capacity is designed to be large, the mill should consist of some small capacity lines. If it is the case that rice mills operate 10 tonnes per hour, the processing line should consist of 4 lines of 2.5 tonnes per hour capacity, and should not be 1 line of 10 tonnes per

hour capacity. This design makes it possible to operate one part of the mill even enough the volume of paddy (for full operation of the mill) can not be collected.

-2. Only dried paddy should be received by the mill, which is dried by the farmers. Mechanical paddy dryers and paddy silos should not be considered to install for the time being. It's recommended to set up concrete floor around rice mill for solar drying. Warehouses for bagged paddy and milled rice storage are also highly recommendable.

-3. Since consumers prefer whole grain rice and it can be sold in high price, the length grading facility should be installed as much as possible.

4.4 Direct Interview Survey for Small Scale Rice Millers

Present situation of the small scale rice millers studied by the Team is stated in the Table 4.15.

Table 4.15 Summary of Direct Interview Survey for Small Scale Rice Millers

Name of Miller	Location	Mill Capacity (Paddy)	Outline
1. Ottofio Food Ltd.	GIDA, Dawhenya Irrigation Project (DIP) Greater Accra Region	0.6 ton/hr	Imported Japanese rice milling facilities by own fund, and operating near DIP project office from April 2001. Milling charge: 155 cedi/kg-paddy
2. Faith, Truth and Love Farms	Ada Foah, Greater Accra Region	0.8 ton/hr	Purchased Japanese rice mill which were supplied by 2KR aid in fiscal year 2005. Mill building is under construction near paddy farm, will be completed soon.
3. Mr. Stanley	GIDA, Afife Irrigation Project (AIP), Volta Region	0.8 ton/hr	Purchased Japanese rice mill which were supplied by 2KR aid in fiscal year 1998. Mill operation had started in 2001. Milling charge: 260 cedi/kg-paddy
4. Kakpor Mills	Hohoe, Volta Region	0.34 ton/hr	Imported Japanese rice milling facilities by own fund. Milling capacity has dropped due to overwork of consumable spare parts. Milling charge: 294 cedi/kg-paddy

Source: Direct Interview Survey 2007, JICA Study Team

During the interview survey at Afife Irrigation Project, the following changes of the rice mill situation have been discovered.

This area is one of the largest rice production areas in Ghana, and large amounts of paddy were processed by rice mills locally in the early 20th. However most of the paddy produced is purchased by traders or rice millers from Kumasi and transported and milled in Kumasi. Therefore only consumed rice in this area is milled by miller in this area, operation condition has declined.

It is interesting that rice milling businesses have been started in the large consumption areas or transporting areas, instead of rice milling in paddy production area.

4.5 Futures of each Scale Rice Mills

The following shows the rice milling charges which were collected during the baseline survey and direct interview survey.

Table 4.16 Comparison of Rice Milling Charges

(unit: cedi/kg-paddy)

Name of Region	Baseline Survey			Direct Interview Survey		
	Interview from Farmers	Interview from Millers				
		Engelberg type	One-pass type	Modern Rice Mill	One-pass type Small Mill	Name of Mills
Western	358	412	357			
Greater Accra				143		IDC Rice Mill (GIDA)
					155	Ottofio Food Ltd.
Volta	347	357	367			
				221		Aveyime Rice Mill
					260	Mr. Stanley' Rice Mill
					294	Kakpor Mills
Ashanti	324	542	383			
Northern	201	177	-			
				241		NASIA Rice Mill
Upper East				212		Tono、ICOUR Rice Mill
Upper West	246	275	-			
Average	306	278	371	204	236	

Source: Baseline Survey 2006 and Direct Interview Survey 2006-2007, JICA Study Team

Specifically, the milling charge of modern rice mills that produce high quality milled rice is lower than the charge of small scale rice mill. The following are the considered as the reasons.

-1. It is considered that all modern rice mills including Aveyime Rice Mill and Nasia Rice Mill had relations with the Government and received government subsidies. The milling charge could be kept at such a low level because their depreciation of initial investment may not be included in their milling charge.

-2. Many modern rice mills are still under Government control, and salaries of the concerned workers are still paid from the government. It means that the labor costs, etc. are not included in the milling charges.

These situations reduce the motivations for the new investigations, etc. for the private rice milling sector.

4.6 Classification of Rice Processing Facilities

Rice processing facilities are examined and analyzed based on milling capacities and quality of milled rice. Rice processing facilities could be classified into 3 categories.

(1) Type-1 Modern Rice Mill

Outline

Milled rice could be sold in big markets on commercial bases. Quality and price of milled rice are the same as imported rice.

Since enough material paddy for normal mill operation can not be collected, operation condition of the mills is poor at present.

Future

In some part of the Volta river basin, irrigated rice farming is made in large scale irrigation schemes. A large quantity of paddy with unified quality is produced under management of agriculture cooperatives. Same variety of paddy is usually planted and mixture of other varieties is less.

Modern rice milling systems with multi-pass whitening machines, length graders, sifting machines, etc. are installed nearby irrigation systems. Milled rice from the modern rice mills has a less bran, is shiny, and well graded by their length. Milled rice is supplied to large consumption areas.

(2) Type-2 Small Scale Rice Mill

Outline

At first, milled rice processed by small scale rice mills was for home consumption and/or sold in neighboring local markets on commercial bases. However, at present, milled rice by these mills have been also sold to large consumption areas to compensate for the insufficient supply of milled rice by the above modern mills.

Future

Rain-fed paddy in lowland and inland valley are cultivated by semi-intensive or extensive farming practices. In these areas, rice is produced by each farmer individually on small scale. Many kinds of rice varieties are produces and those are mixed through cultivation and post harvest activities.

Except manpowered milling, most of paddy produced is milled by small scale rice mills located in each village. The quality of milled rice is lower than one from large scale rice mills, i.e. a lot of bran, dusty, and many broken rice.

Quality of rice milled by small scale rice mills is lower than the imported rice and is not competitive. The majority of this milled rice is consumed at household level. A limited quantity is sold locally.

(3) Type-3 Man powered milling method done in the house

Manually milled rice is only for home consumption. This manpowered milling is out of the Study because this practice will not be done in the future.

Based on the difference of the harvesting methods stated above, rice processing facilities and its capacity, typical flow of rice post harvesting activities in Ghana shall be shown in Figure 4.4 in the next page:

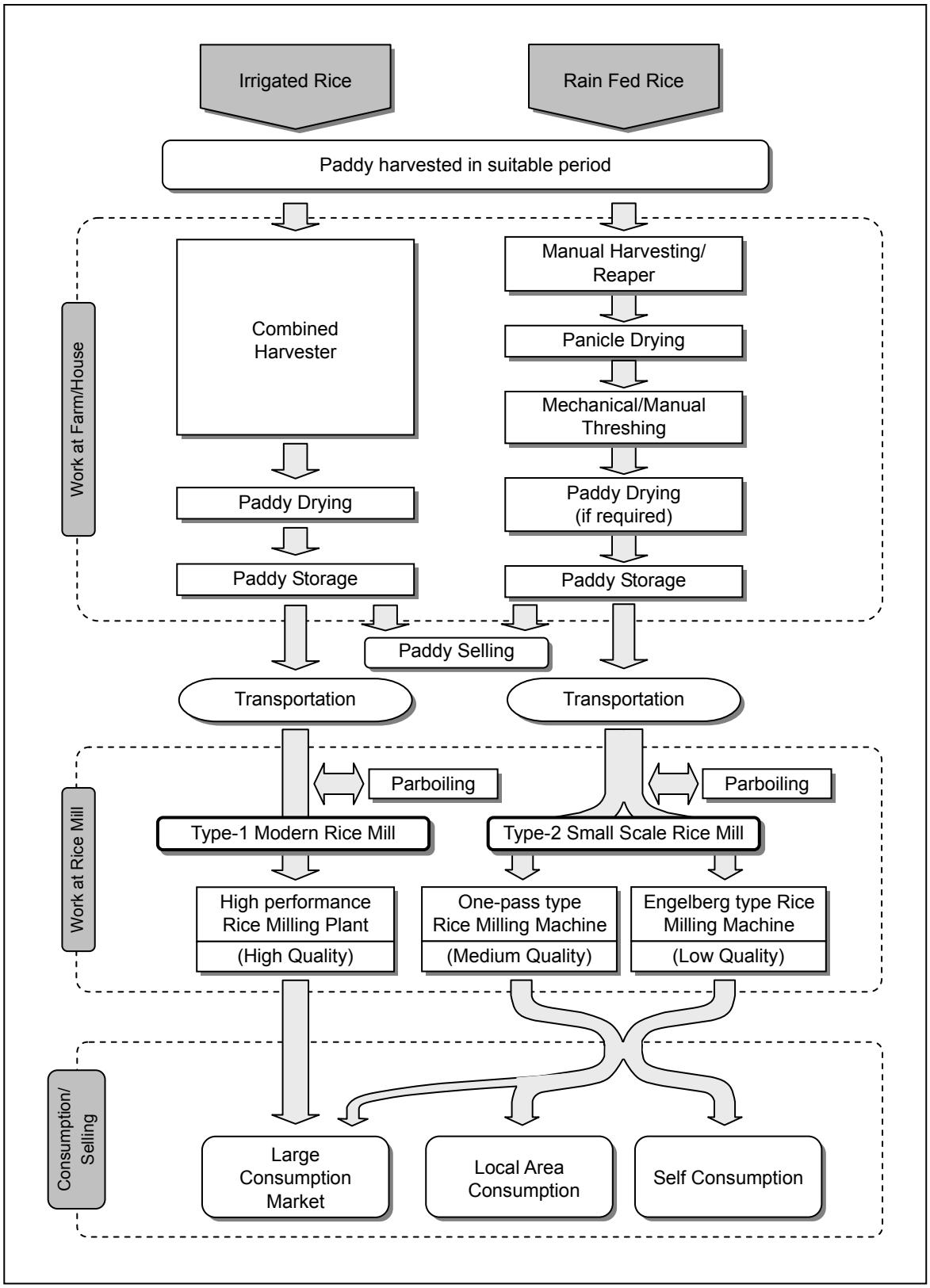


Figure 4.4 Flow Chart of Rice Post Harvest in Ghana

4.7 Issues to be considered in the Master Plan and Action Plan

When the draw up the Master Plan and Action Plan for post harvest processing, it is impossible to consider together with up-stream of post harvest (= Paddy Production) and down stream of post harvest (= Distribution and Marketing). To motivate each of the stakeholders to this direction, it is necessary to prove the individual profits to be generated from the efforts for quality improvement.

-1. Almost all rice millers earn from milling charges, not the sale of milled rice, regardless of the size of rice mill. Rice farmers as well as traders transport paddy into rice mills, and rice millers collect only milling charge from them. The current milling charge is not related to the quality of milled rice, thus rice millers' incentive concerning quality improvement is quite low. This low incentive is a crucial limiting factor against promotion of quality improvement of milled rice.

-2. Since the earning rate of the rice millers is comparatively high and stable, rice millers' incentive concerning quality improvement is not fixed. In order to give millers an incentive for quality improvement, it is needed to develop and show the mechanism that high quality rice can make high earning rate.

Paying attention to the above issues, the following development components are proposed.

(1) Quality Improvement of Milled Rice

This component aims at establishment and dissemination of rice processing technology for domestic rice, which is competitive to imported rice in terms of quality.

This component consists of two activities for improvement of quality of milled rice. One is to transfer post-harvest technology to rice farmers. The other is training on rice milling and improvement of milling facilities including a large scale mills beside the irrigation schemes and one-pass type mills. This component covers technical investigation and financial validation of existing rice mills and support for procurement of required facilities above.

(2) Support for Maintenance and Replacement of Rice Mills

The component on "Quality Improvement of Milled Rice" as above aims at establishment and dissemination of rice processing technology for domestic rice in farmers and millers, which is competitive to imported rice in terms of quality. This component targets rice millers for maintenance and replacement of existing rice mills.

Currently small scale rice millers purchase spare parts and consumables in market, however small-scale rice millers without financial sources need to get financial assistance to maintain the mills. In order to produce and expand high quality rice, Engerberg rice milling machines should be restricted in the future and one-pass type rice mills shall be promoted in remote areas. In order to promote this, MOFA shall support procurement of machines, parts and consumables. Furthermore, medium and long term loans shall be arranged for small-scale rice millers and farmers' groups.

(3) Simple Grain Storage Extension

After threshing, paddy grains could be stored temporarily. However, there are a lot of losses in storage due to various damages caused by insect, over dry and water leaking, etc.

Respective farm households have individual grain storage and common storage managed by community does not prevail. It might be due to scattered farmers, poor road networks, difficulty in management, land acquisition and construction cost, etc. Individual storage rather than community storage will be realistic at present. Grain storage with high and flat floor is proposed for reduction of losses. In this program, tarpaulin sheets will be supplied for roofing if necessary.

Materials for grain storage are proposed to use locally available materials such as bamboo which is naturally grown and available plenty. So that farmers can easily obtain materials and construct grain storage by themselves.