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Assessing Performance of Irrigation of Rice in Ghana

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ABSTRACT

Rice irrigation schemes in Ghana number up to 22 yet their output is so low that it creates a huge consumption deficit leading to huge rice import bill, over 500 million dollars per year. The management of these schemes has been noted with poor record keeping and high operational and maintenance cost. Some schemes are extremely neglected due to lack of active stakeholder participation. The rice irrigation capacity utilization in the existing schemes is unsatisfactorily, the reasons for the current situation are indicated as poor management practices, lack of governmental support to promote the scheme and heavy dependence on natural rainfall. Rainfall is unpredictable, a situation which is a draw back on existing rice irrigation schemes.
For a complete self-sufficiency, rice irrigation practices must be seen in its right perspective to ensure the success of the schemes and become integral variable in the national economy.

Keywords: *Ghana, Irrigation, Rice, Production, Schemes, Challenges, Consumption*

1. INTRODUCTION

Agriculture is still a major sector in many countries, and agricultural activities provide developing countries with food security and revenue. The average rate of irrigation development for the countries of sub-Saharan Africa from 1988 to 2000 was estimated at 43,600 ha/year (FAO, 2001). If this rate continues, then an additional 1 million hectares will be brought into irrigated production by the year 2025. Irrigated agriculture is a later day philosophy which was promoted by the fact that natural rainfall is largely seasonal and heavily unreliable. In Ghana, agriculture is the back bone of our fragile economy. It is the largest contributor to the Gross Domestic Product (GDP) accounting for about 50%. It also accounts for about 60% of export earnings and indirectly supports about 80% of the total population economically through creation of jobs (farming), distribution of farm products and provision of other services to the agricultural sector (MOFA, 1991).

In recent times, rice has progressively become a convenient national staple substitute in most Ghanaian homes. As a result there is high demand for rice than any food stuff and the successive governments have had to spend a lot more on rice importation into the country to support what is produced by the local farmers in order to reduce the demand deficit. According to statistics, Ghanaians consume 600,000 metric tons of rice annually out of which our local farmers produce only 30% of the demand.

This is a worrying situation to the emerging economy, since there is much burden on the Ghanaian importation bill.

To help check this challenge, irrigated rice agriculture must be given the needed attention. It is imperative to note that the total area under irrigation between 1990 and 1992 was estimated as 0.7% of the total area of agricultural land (World Development Indicators, 2009). In the 2009 report however, irrigated land between 2003 and 2005 was estimated as 0.5% of the total area of agricultural land, registering a sharp reduction in irrigated agriculture. A situation indicating that there is much dependence in rain fed agriculture.

The study investigated into the various irrigation schemes, their capacity in the area of rice production. Investigate into the challenges in the overall performance and management style of the schemes which are basically for rice production. Recommend where possible, the appropriate suggestion to impact on rice irrigation in the country.

1.1 History of Irrigation Development in Ghana

Irrigated agriculture in Ghana dates a little over ten decades ago (Smith, 1969). Small scale irrigated agriculture practice across the country dates back as early as 1880 in Keta area on land above flood level between the lagoon and the sandbar separating it from the sea. The method was so adopted in the area, in the sense that the natural conditions was not in support of the principle of shifting cultivation in agriculture as practiced elsewhere (Smith, 1969). The first irrigation scheme in the country was set up by the government in 1920. This was integral part of the then Winneba Water Supply Project (Smith, 1969). (Agodzo and Bobobee, (1994) indicated that some shallow tube-well irrigation could also be identified in the south-eastern part of Ghana as at 1930's. Soon after independence in 1959, the first national irrigation project, in Dawhenya, was begun. However, available records reveal that Asutuare Irrigation Project was the pioneer scheme in 1967. The 1950's and 1960's witnessed some water development schemes which

accounted for about 240 earth dams and dug-outs in the north and about 66 in the Ho-Keta plains of the south purposely to provide water for dry season irrigated agriculture. Currently irrigation schemes are managed by the Ghana Irrigation Authority (GIDA) set up by Suprem Military Council Decree (S.M.C.D) 85, 1977 and their function is to provide for the development of irrigation and other related matters.

2.1 Justification of Rice Irrigation in Ghana

There is obviously no dispute about the fact that water is an important input in agricultural production in Ghana beside labour force. Virtually, all agricultural production in Ghana depends heavily on natural rainfall which can be unpredictable. According to available statistics, Ghanaians consume 600,000 metric tons of rice annually out of which our local farmers produce only 30% of the demand. The remaining two-thirds, worth over 500 million dollars, are imported. The figure is alarming when it is juxtaposed against the situation in 1999-2000 when the rice import bill was 100 million dollars. This situation is very worrying to the emerging economy, since it posses much burden on the Ghanaian importation bill. The gab can only be bridge by comprehensive irrigated rice agriculture where there is a complete shift from total dependence on natural rainfall to all year round water availability. A well developed scheme will serve as a panacea to achieve; food security, poverty reduction, and rural employment.

Despite irrigation's considerable potential and the emphasis placed on it in recent plans, the proportion of potential irrigable land actually under irrigation is insignificant. In addition, the performance and productivity of existing irrigation schemes, particularly those that were publicly developed, are generally low (GIDA/JICA 2004). Finally the agricultural lands capacity on rice production potential is exceptionally good to the extent that it can supply for the whole of the sub-region with a good return on revenue generation to support the national economy. However, this cannot be achieved for now, since there is much dependence on rain fed cultivation with poor yields.

2. STUDY AREA

Ghana is fairly well endowed with water resources, but there is a high variability in the amount of available water within the year and over several years. Total land surface area is 238,000km^2. It is located between lat. 4^0 30$^{'}$ and 11^{0}N and longitude 1^0 10'E and 3^{0}15'W. It shares borders with Cote d'Ivoire on the West, Republic of Togo on the East, Burkina Faso on the north and Atlantic Ocean (Gulf of guinea) in the south. Ghana receives average annual precipitation of 283.2 billion m^3. The mean annual rainfall reaches a high of 2,240 mm in the extreme southwest. It reduces eastward and northwards to about 800 mm in Accra on the southwest coastal savanna zone, and 970mm in the extreme northeast. Mean annual temperature is 30^o C. Relative humidity is highest at the coast with a mean of 90% and a dry season low of 20% in the north. Potential evapo-transpiration ranges from 1,011mm in the rain forest zone to 2,412 mm in the northern savannah zone (FAO, 2005).

2.1 Irrigation Schemes in Ghana

There are about forty official irrigation schemes across the length and breadth of the country. The Ghana Irrigation Development Authority (GIDA) has 22 irrigation schemes cultivating rice under its Jurisdiction covering about 14,100 ha out of which 53% are developed and about 5478 ha is actually put under irrigation (status of June 2003). Table 1 indicates the various irrigation schemes and their potential across the country.

2.2 Rice Irrigation Schemes in Ghana

The self-sufficiency policy, adopted in Ghana during the 1970s, resulted in the creation of the Ghana Irrigation Development Authority (GIDA) of the Ministry of Agriculture as a semi-autonomous organization in 1977. In GIDA, a lot of emphasis was placed on the development of large-scale irrigation projects for the production of rice. The ultimate aim was to reduce the country's dependency on imported rice. At present, GIDA has more than twenty on-going projects, scattered throughout the country, with sizes of schemes ranging from 10 to about 3000ha. The total area developed by GIDA for irrigation and mostly rice cultivation is at present about 10,000ha. Rice yields on the irrigation projects vary between 4.0–6.0t/ha, with an average yield of about 4.6t/ha. Yields of rice on irrigation schemes, and cropping intensity, are directly related to the amount of water available from season to season. It is estimated that the contribution of irrigated agriculture to the total national rice production needs to be about 24% in order to satisfy national demand. Schemes into rice irrigation cultivation are shown in the Table 2. Only seven of the schemes are seriously into rice irrigation. The others are shared schemes which in cooperates mix cropping; involving rice and other crops especially vegetables.

Table 1: Irrigation projects and their potential

No.	Irrigation Project	Irrigation Potential(Ha)	No.	Irrigation Project	Irrigation Potential(Ha)
1	Accra Plains	178.2	21	Kpong	2024
2	Adidome	200	22	Kpong Farms	1000
3	Affife	1012	23	Mankessim	324
4	Afram Plains	202	24	Medium and samall schemes	101205
5	Akumandan	810	25	Nobewam	215
6	Ashiaman	235	26	Okyereko	121
7	Asutuare	2000	27	Pwalugu	95175
8	Aveyime	8000	28	Passam	1250
9	Avu-Keta (MPS)	30370	29	Sata	40
10	Avu-Keta (PF)	40	30	Small schemes (ASIP)	2900
11	Ayensu	3500	31	Subonpan	20
12	Bontanga	540	32	Tamne	500
13	Bui (MPS)	32400	33	Tanoso	1200
14	Dawhenya	486	34	Tono	2632
15	Demon	400	35	Valley Bottom	600
16	Dodenu	20	36	Vea	1417
17	Golinga	100	37	Volta Lakeshore	400
18	Inland valleys (IVRDP)	4600	38	Weija	2267
19	Kikam	27	39	Yapei	5200
20	Komenda	1215	40	Zongo-Macheri	4000

[Compiled from FAO 1985, Agodozo and Bobobee (1994)]

Table 2: Irrigation projects growing rice and/or other crops in Ghana

Location/Scheme	Potential area (ha)	Developed area (ha)	Irrigation system (G- gravity, P- pumping scheme)	Major crops cultivated
Ashiaman	155	135	G	Rice
Dawhenya	450	191	P+G	Rice
Kpong	3028	1400	G	Rice, Vegetables
Weija	1200	220	P	Vegetables
Afife	880	880	G	Rice, Vegetables
Aveyime	280	60	P+G	Rice
Kpando- Torkor	400	40	P	Vegetables
Okyereko	100	40	P+G	Rice
Mankessim	320	17	P	Vegetables
Amante	300	101	P	Vegetables
Dedeso	880	30	P	Vegetables
Akumandan	150	65	P	Vegetables
Nobewam	150	120	P+G	Rice
Sata	32	32	G	Vegetables
Subinja	150	60	P	Vegetables
Tanaso	1200	64	P	Vegetables
Bontanga	540	450	G	Rice, Vegetables
Golinga	130	26	G	Rice

Libga	40	20	G	Vegetables
Kikam	35	27	P+G	Rice
Tono	2632	2400	G	Rice, Vegetables
Vea	1000	1000	G	Rice, Vegetables
Total	14052	7378		

Source: GIDA 2000

3. MATERIALS AND METHODS

The methods used for this study include collation of information, reports, and data from GIDA, Ghana Ports and Habour Authority, Institute of Water Management International, and other sources. Review of relevant literature, including a wide range of files, online publications, and published and unpublished reports on relevant works on rice cultivation schemes in Ghana. Interviews with key informants of the various farmer groups of the irrigation schemes were also used as part of the study.

4. RICE PRODUCTION IN GHANA

According to Mobil and Okran (1985), rice has been produced in Ghana for a long time. During the 17th and 18th centuries, it was already one of the major commercial food crops. Its importance was next to millet and maize and it was cultivated more than yam and sweet potato, the two principal root crops in the country then. Until the 1920s, most of the rice in Ghana was grown in the Volta and Western Regions, with cultivation carried out mostly by females, while males focused on cash crops such as cocoa, rubber and coffee. Most of the rice varieties were grown without any improvement, as they were inherited from ancestors, and some of these varieties are still in cultivation. In inland valleys, which are one of the main ecological environments in the country, rice is grown in flooded fields.

In recent times there have been calls by certain interest groups on government to raise tariffs on imported rice from 20 percent to 30 percent. According to this group of people, they believe this would help boost domestic rice production and consequently reduce volume of imported rice. Ghana experienced a rapid dietary shift to rice, particularly in the urban centres, during the early post-independence period (starting 1957). The trend is attributed to increased income, favorable government pricing policies, good storability of rice and ease of cooking (Nyanteng, 1987). Since then demand has been on the increase progressively.

4.1 Domestic rice production

Available data show that Ghana's rice production estimates range from 200,000 to 300,000 MT of paddy rice or roughly 120,000 to 180,000 MT of milled rice, the bulk of which comes from the Upper East, Northern and Volta Regions. Rainfall remains the greatest driver of production variance. Ghana's rice production can be categorized into three primary cropping types as indicated by Table 3. Lowland rain-fed, which includes rice planted in the receding waters of the Volta and other rivers, accounts for 78 %t of production; upland rain-fed accounts for 6 %, and irrigated rice accounts for 16 % as indicated in Table 3. Rice production expanded steadily from 1994 to 2004 primarily from an expansion of land under paddy production.

Table 3: Categorization of Paddy Fields in Ghana

Indicator	Low land Rain-fed	Upland Rain-fed	Irrigated	Total
Planted Area (Ha)	93,750	18,750	10200	122,700
Paddy (MT/Ha)	2.4	1	4.5	2.4
Paddy Production(MT)	224,700	18,750	45,900	289,350
% of Total Area	75	15	10	100
% of Total Production	78	6	16	100

Source: Ghana, MoFA and JICA (Final Report, March, 2008).

By the end of 2008, rice production in Ghana was estimated at 301,921 MT of paddy; yielding roughly 181,000 MT of milled rice, produce on 132,921 hectares, resulting in an average yield of 2.27MT/Ha of paddy for upland and lowland rice aggregated. It is generally agreed that current domestic production accounts for 30 % of domestic consumption, approximately 600,000 MT of milled rice (Awuni, 2006).

4.2 Consumption Patterns

Figure 1 depicts the deficits in domestic rice production, and imports over the period 1960 – 2012 as well as total domestic rice consumption over the same period. It is so clear that the national deficit is on a high ascendancy. The results show that there is much dependency on rainfed agriculture or a lot of improvement has not been done in most irrigation schemes. The rice production in the country was highly encouraging in the early 70's.

Recent research by (Awuni, 2006) confirmed that most important food items in the diet of the urban poor are cereals. Across all cities, maize derivatives are the most common food consumed about 42.3 % followed by rice, 33.7 %. While in Accra and Tamale, maize derivatives appear to be the first choice of food items, in Kumasi and Sekondi-Takoradi, rice appears to be the first choice of most urban poor families. Current rice consumption estimates range around 30kg/capital per year as indicated in the Table 4 with projected demand in 2015 of as much as 63kg/capita per year driven by steady gains in income and population growth of 27.5 %.

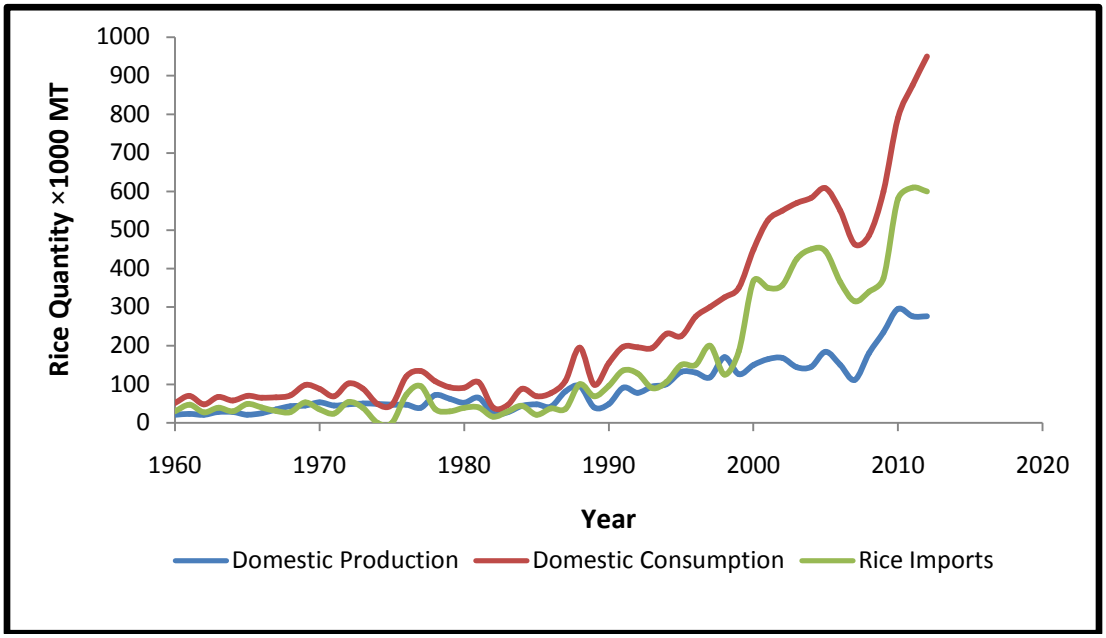

Fig 1: Ghana milled rice production, consumption and imports

Table 4: Estimation of Per Capita Rice Consumption for Rural and Urban areas of Ghana

Indicator	Urban	Rural	Whole Country
Population	9,170,000	11,360,00	20,530,00
Per Capita (Kg)	38	4.5	22.1
Total (MT)	348,500	104,800	433,300
Consumption Ratio (%)	76.9	23.1	100

Rice production was encouraging in the north western and north eastern part of the country as shown by Table 5. A reason largely attributed to self-sufficiency policy, adopted in Ghana during the 1970s. However due to the neglect of governmental support of the irrigation schemes, these achievements became largely unsustainable.

Table 5: Paddy rice production by regions, Ghana, 1978 - 1980

Region	Paddy Production (1000t)	% National Production
Northern	170	51
Western	29.3	10.5
Eastern	22.3	8
Brong Ahafo	20.8	7.5
Volta	14	5
Upper	14	5
Ashanti	4.2	1.5
Central	4.2	1.5
TOTAL	278.8	100

Source: Ghana Statistical Services

4.3 Performance of Rice Production Ecologies in Ghana

Rice is produced in all the ten regions of Ghana, covering all the major ecological-climatic zones, including the Interior Savannah zone, the High Rain Forest zone, the Semi-deciduous Rain Forest zone and the Coastal Savannah zone. Within each agro-ecological zone there are distinct rice ecosystems:

The rainfed ecology (i.e. drylands and lowlands) accounts for 78 % of the production area, the irrigated ecology for 16 % and the inland swamps and valley bottoms for 6 %. The rainfed lowland/hydromorphic ecology is responsible for more than 60 percent of the rice area in Ghana and over 80 percent of the rice area in the Interior Savannah zone where rainfall is mono-modal as observed by Oteng, (1997). The main rationale behind the inland swamps and valley bottoms scheme is that, with development of good but simple water and soil management practices, higher crop productivity could be sustained in the valley bottoms and swamps, as observed by Otoo (1994).

5. CHALLENGES IN IRRIGATION ECOLOGIES IN GHANA

5.1 Rainfed ecologies

The major challenges are rodents and birds. In the Transitional, Semi-deciduous and High Rain Forest zones it is imperative to fence the crop to protect it from the large rodents, Thryonomis swindarianus or grass cutters, otherwise the whole crop could be destroyed overnight if attacked. The other equally important constraints are the low and erratic rainfall, low inherent fertility of the soils and low level of technology used.

Excessive rainfall regimes, subject many rice fields to long periods of inundation. The uncontrolled floods tend to affect field operations such as weed control, fertilizer application, bird control and harvesting, thus resulting in poor yields. Prominent constraints encountered in the valley bottoms and swamps are a lack of suitable varieties and weed and pest problems.

5.2 Irrigated Ecology

The greatest constraint to production is, however, the ever-increasing bird and rodent population, which seriously threaten the growth of the rice industry. The problem is exacerbated by the continuous monocropping of rice season after season in the absence of a viable alternate crop in the rice basins. Meanwhile, under the National Agricultural Research Programme (NARP), efforts are being made to develop a sustainable rice-based cropping system to break the cycle of rice monocropping. The weed problem appears to be the next most important problem after pests.

The most obnoxious weeds which climax in the irrigated rice culture are Ischaemum rugosum, Echinochloa colonum, Cyperus rotundus and Phyllanthus spp. The weed control problem has been worsened by the withdrawal of subsidies on agricultural inputs, and farmers are resorting increasingly to hand weeding while also reducing their farm size. Lack of infrastructures such as combine harvesters, reapers, threshers is seriously affecting rice output in this ecology**.**

5.3 Climatic Uncertainty and Other Constraints

The rainfall pattern is erratic causing droughts and/or floods, and these environmental problems result in poor germination and harvest failure. Farmers also complain about poor soil fertility, as a further limitation to rice production. Difficulties with land acquisition for rice farming were also mentioned as one of the constraints in two communities. However, the majority of respondents mentioned lack of credit facilities and support mechanisms for successful agricultural production, as their main problem rather than environmental conditions.

5.4 Energy Crisis

Most of the irrigation schemes have serious crisis with electricity. There is high level of unpaid bills as a result some of the schemes are disconnected from the national grid. There is therefore a sharp reduction in the production of the irrigated schemes; since heavy duty electrical pumps are currently substituted with smaller diesel operated ones as the case of Nobewam. In some cases the scheme has become virtually manually operated. Subsequently, Ghana's guest to be self-sufficient in rice production has become derailed.

5.5 Maintenance of Structures

On irrigated projects in Ghana, the farmers mostly do maintenance of irrigation structures themselves. The maintenance is done on the main channels, laterals and sub laterals, head ditches, bunds and drains. The government's commitment towards the maintenance of the irrigation schemes is very low. There is therefore a complete neglect of some of the schemes leading to complete breakdown.

5.6 Government Policy on Irrigated Agriculture

It is the Government's intention to hand over all the irrigation projects to Farmers' Organizations who will be responsible for the administration of the respective projects without any government subvention.

Currently, the Government is suppose to provide machinery services for hire to the farmers and also carries out rehabilitation works on the projects but this is not forth coming. Extension officers are very few and they have to shuttle between projects sites over a relatively long distances without any means of transportation. Hence the quality of their attached service to the various projects, helping farmers to improve technology is relegated to the background.

5.7 Departure of Farmers from Irrigation Schemes

Higher wages in urban areas and rural poverty cause labour migration from the countryside to the urban centers. This creates labour crisis on the farmlands particularly during seasons when farm work is heaviest. When labour becomes scarce and more expensive, farmers are forced to use labour saving technologies including herbicides and mechanisation. In the long term this may lead to an increase in the size of rice farms.

The declining efficiency of chemical fertilisers, pesticides and irrigation water induced by the above mentioned ecological problems together with the increasing costs of labour and inputs relative to the price of paddy have contributed to making rice farming less profitable. Liberalisation and the globalisation of the rice market have put further pressure on rice prices. The general decline in the terms of trade between agricultural and industrial products and services has also helped to marginalize rice farming economically and farmers are being forced to look for other sources of income. Young people are being driven to seek employment outside agriculture and, in the long-term, this may mean that the number of farmers will decline.

6. CONCLUSION

Given the existing structure of the local rice industries, increasing the tariff rates on imported rice would not be detrimental to the importers but will rather affect the common urban poor consumer. In the long run, however, if the structures are put in place, local rice production and marketing can benefit directly. What is needed is effective organization and intermediary actions by the government to enhance efficiency of the local rice industry and make it more competitive.

There is the need for a systematic and planned local capacity building in order to improve rice cultivation in the country and this requires that the key aspects of the domestic rice sector, such as seeds and variety selection, mechanization and equipment, agronomic practices, threshing, drying, cleaning parboiling and milling be thoroughly overhauled and sustainably managed. A solid foundation must first and foremost be laid to enable the domestic rice sector to take off without any ripple effect.

A number of adaptation options in agriculture face a dilemma. Increasing water availability and increasing the reliability of water in agriculture, i.e. through irrigation, is one of the preferred options to increase productivity and contribute to poverty reduction. Prospects for rice irrigation development now and the future are bright provided it will be accorded the required priority at the highest level.

The issue of cost has always bedeviled the irrigation schemes. This should be contained by the government through clear cut policies in order to make irrigation and its management affordable. Currently less than 4% of the total national budget is allocated to the agric sector although it is the largest provider of Ghana's population with jobs. Again the database for rice irrigation must be highly improved through proper record keeping on projects and research. Research must also aim at improving the yields and optimizing water usage on projects. Lastly local capacity to manage rice irrigation schemes should also be developed by running good irrigation training programmes at the training institutions.

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