CURRENT STATUS AND SOLUTIONS TO AGRICULTURAL MECHANIZATION FOR SMALL HOLDER RICE PRODUCERS IN GHANA

By

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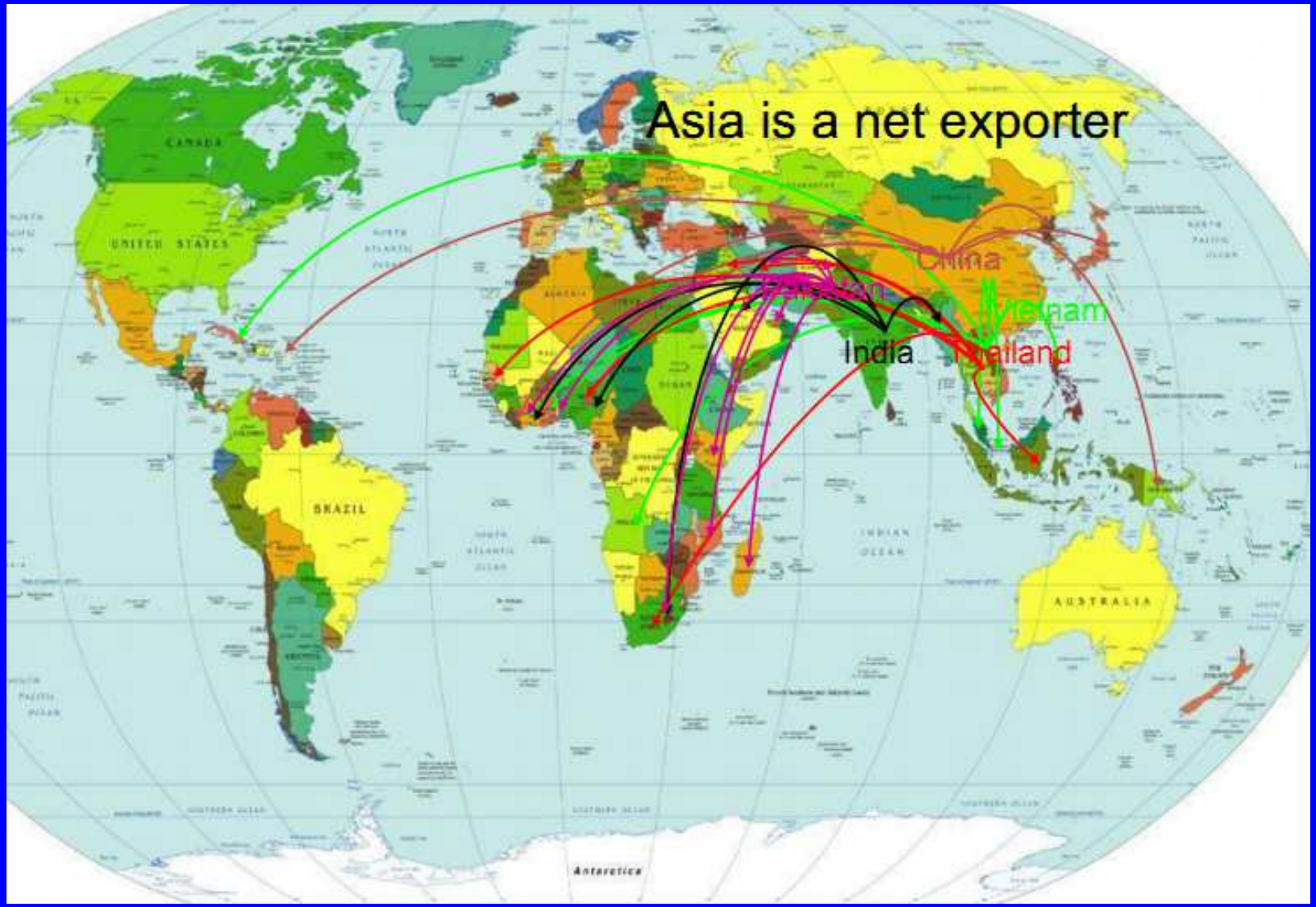
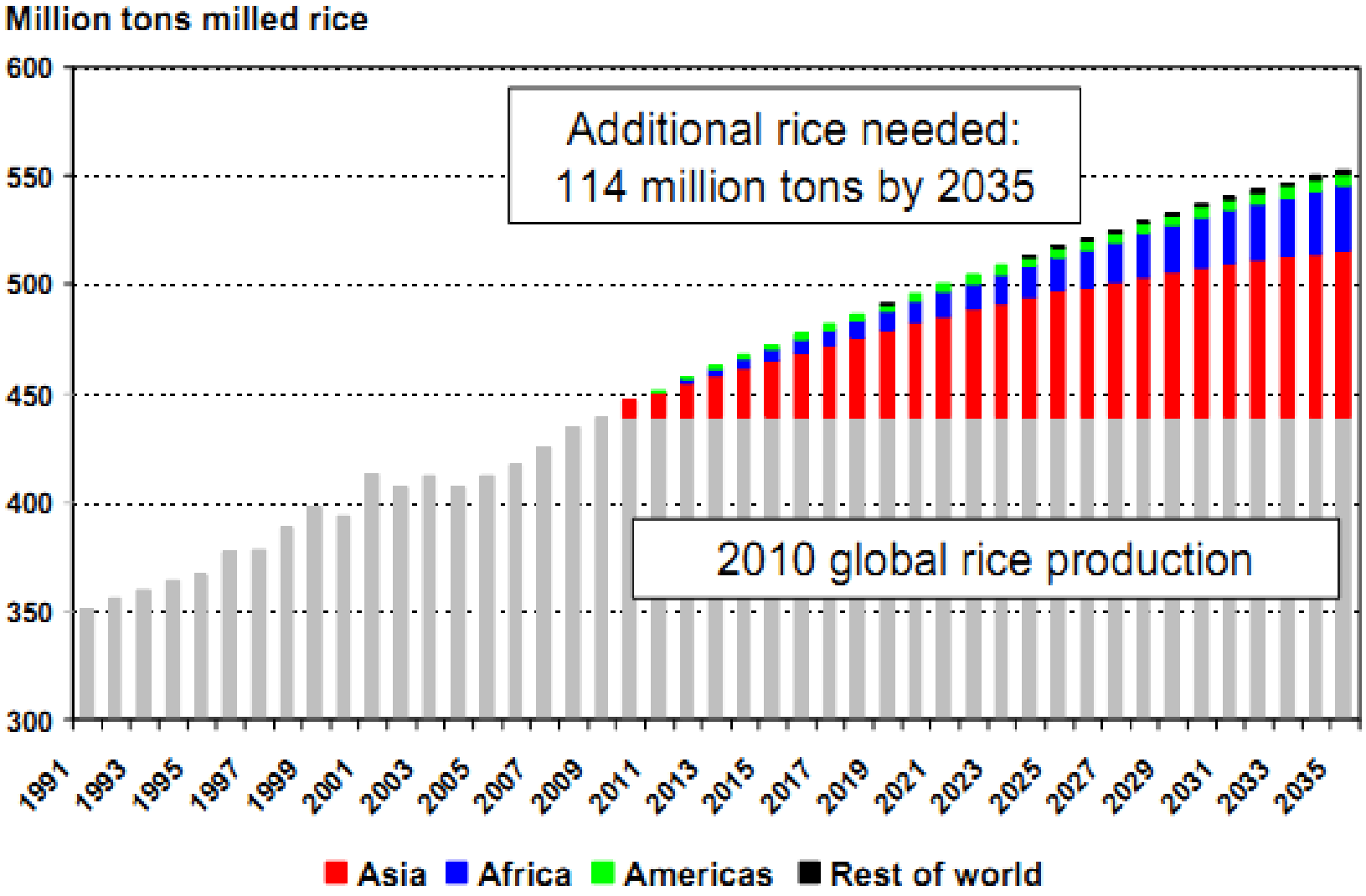
GLOBAL RICE PRODUCTION &SUPPLY



Source:

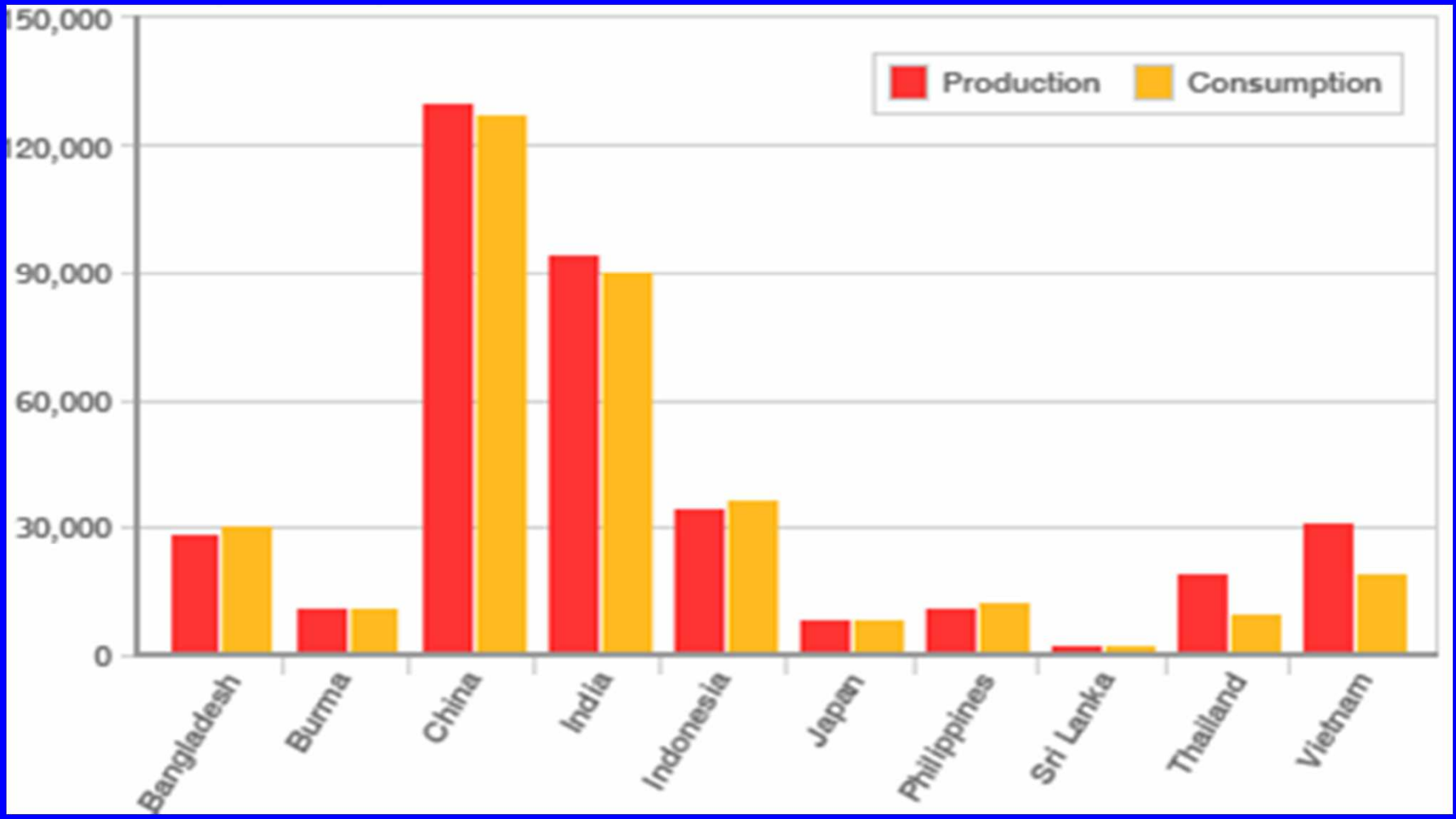
PREDICTION OF GLOBAL RICE PRODUCTION TO 2035



(Source: A Global Rice Science Partnership, June 2010)

MILLED RICE PRODUCTION & CONSUMPTION OF MAJOR RICE PRODUCING COUNTRIES IN THE WORLD

Metric tonne (thousands)



(Source: USDA, March 2008)

PART I

CURRENT STATUS ON RICE CONSUMPTION & PRODUCTION AND AGRICULTURAL MECHANISATION IN GHANA

GHANA IN AFRICA

Ghana has Volta lake crossing from the South to the North with 3 major ecological regions for rice production being rain-fed upland, rain-fed lowland and irrigated land.

GHANA POPULATION

(Source: www. Tradingeconomics.com/ World Bank)

CURRENT STATUS OF RICE CONSUMPTION IN GHANA

- Rice has become the second most important food staple after maize for Ghanaian. Approximately 67% of middle class Ghana population is consuming rice on regular basis;
- Over the last 10 years (1999-2008), rice consumption in Ghana has increased from 17.5kg to 38.0 kg /person/year. By the year of 2018, it is expected to grow up to 63 kg/person/year;
- The rice consumption of Ghana in 2014 is 831,000 metric tons. Based on the assumption of expected growth rate in rice per capita consumption, population and urbanization, Ghana's rice requirement will be in the range of 1.4 – 1.6 million tons per annum by 2018;
- Ghana is dependent largely on imported rice. On the average, rice import is about 400,000 tons/year;
- The demand of rice in Ghana is catered by imported rice, up to 52% and by local rice production of 48%;
- It is desired that Ghana will double local rice production by the year 2018 so as to contribute to food security and to increase income of the rice farmers.

BASIC INFORMATION OF AGRICULTURE OF GHANA

- Small scale production with family operated farms;
- About 2.74 millions households operating in the agriculture (crops farming & livestock production), occupying 80% Ghana's total agriculture output;
- About 90% of farm holdings are less than 2 hectares in size;
- Number of medium and large-scale farms has been increasing & farming systems have been changed in the last 30 years;
- However, rice production in Ghana is a labour intensive activity restricting expansion of farm cultivated area;
- Application of mechanization is to expand farming areas, to increase productivity and efficiency of agricultural production, to increase food security, to combat poverty, to improve income of the farmers and to sustain the rice production in Ghana.

LAND FOR CROPS PRODUCTION

High land areas of Ghana is mostly for production of upland crops like maize, yam, cassava, sorghum, beans, etc.

Low land mostly for rice production – Irrigated rice fields in Volta regions

RAIN-FED UPLAND FOR RICE PRODUCTION

Rain-fed upland area occupying about 6% of the arable area is characterized by an erratic rainfall pattern.

- There are problems of weed competition, low soil fertility and pest damage.
- Rice varieties suitable for the ecology are short duration and drought tolerant types.

RAIN-FED LOWLAND SUITABLE FOR RICE PRODUCTION

- Rain-fed lowland area occupies up to 78% of the arable area, suitable for rice production, but over 5 million hectares still remained unexploited;
- The rain-fed lowland has problems of water management with frequent flood.

If the water is managed well and the land is mechanized; the rice yield will increase and the land will become the most profitable rice crop area.

IRRIGATED LAND FOR RICE PRODUCTION

Irrigated land areas occupy only about 16% of the total arable area , but record the highest rice yield because the levels of technology utilization (improved land preparation, improved varieties, fertilizer application and weed control through water management) are higher than those in both rain-fed lowland and rain-fed upland area. It may be suitable for rice-fish culture system.

Irrigated rice production in Fievie – Sogakope, Volta region

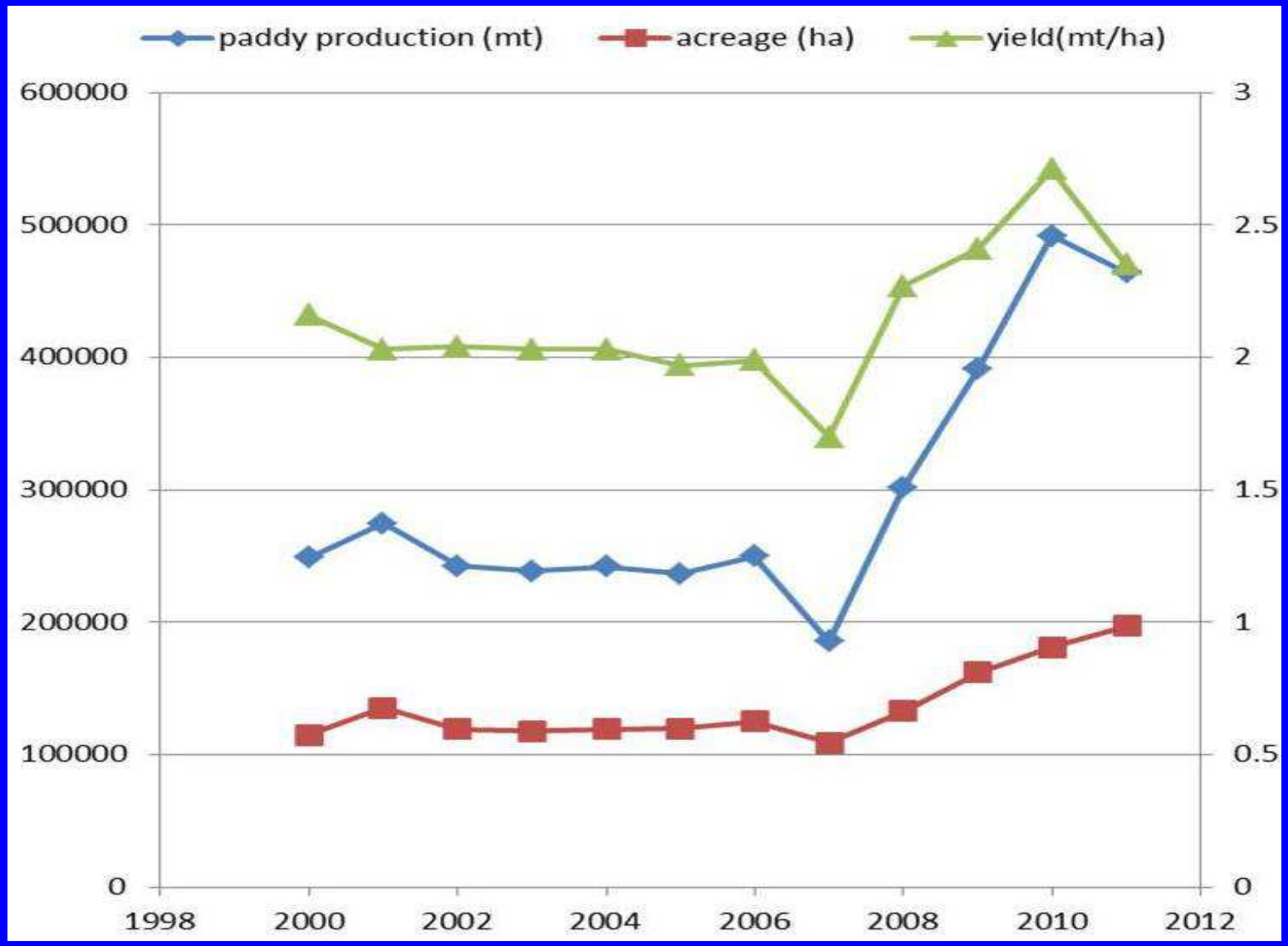
There are about 21,860 hectares of land along Volta lake irrigated for rice production at an intensity of 1-2 rice crops/year

DISTRIBUTION OF RICE PRODUCTION BY REGION & AGRO-ECOLOGICAL ZONES IN GHANA

Region	Agro-Ecological Zone	Output (MT)	Area (ha)	Yield (MT/ha)
Northern	Guinea Savanna	185,877	62,930	2.95
Upper East	Sahel Savanna	135,221	47,361	2.86
Volta	Coastal Savanna	67,229	21,860	3.08
Ashanti	Semi-Deciduous Rainforest	27,705	10,115	2.74
Western	Rainforest	23,022	17,130	1.34
Eastern	Semi-Deciduous Rainforest	20,703	6,630	3.12
Greater Accra	Coastal Savanna	12,741	2,323	5.48
Upper West	Sahel Savanna	7,291	4,570	1.60
Brong-Ahafo	Forest Savanna Transition	6,573	4,020	1.64
Central	Semi-Deciduous Rainforest	5,241	4,290	1.22
Total	National	491,603	181,229	2.71

(Source: Statistical Research and Information Directorate (SRID), 2006)

RICE PRODUCTION IN GHANA



CURRENT STATUS OF RICE PRODUCTION IN GHANA

Ghana has 3 major ecological regions for rice production being rain-fed upland, rain-fed lowland and irrigated land;

- Rain-fed upland area occupying about 6% of the arable area is characterized by an erratic rainfall pattern. There are also problems of weed competition, low soil fertility and pest damage. Rice varieties suitable for the ecology are short duration and drought tolerant types;

- Rain-fed lowland area occupies about 78% of the arable area, suitable for rice production but remains largely unexploited. Conservatively, it is estimated that Ghana has over 5 million hectares of unexploited rain-fed lowlands. The rain-fed lowland has problems of water management with frequent flood. If it is managed well and mechanized, its yield can increase and it will be the most profitable rice crop area;

- Irrigated land area occupying about 16% of the arable area records the highest rice yields because the levels of technology utilization are higher than that in both rain-fed lowland and rain-fed upland area (improved land preparation, improved varieties, fertilizer application and weed control through water management). It may be suitable for rice-fish culture;

- A total rice cropping area of Ghana in 2008 is 118,000 hectares;

- There is about 295,000 rice farming households in Ghana (2008) with an estimated average household holding of 0.4 hectares;

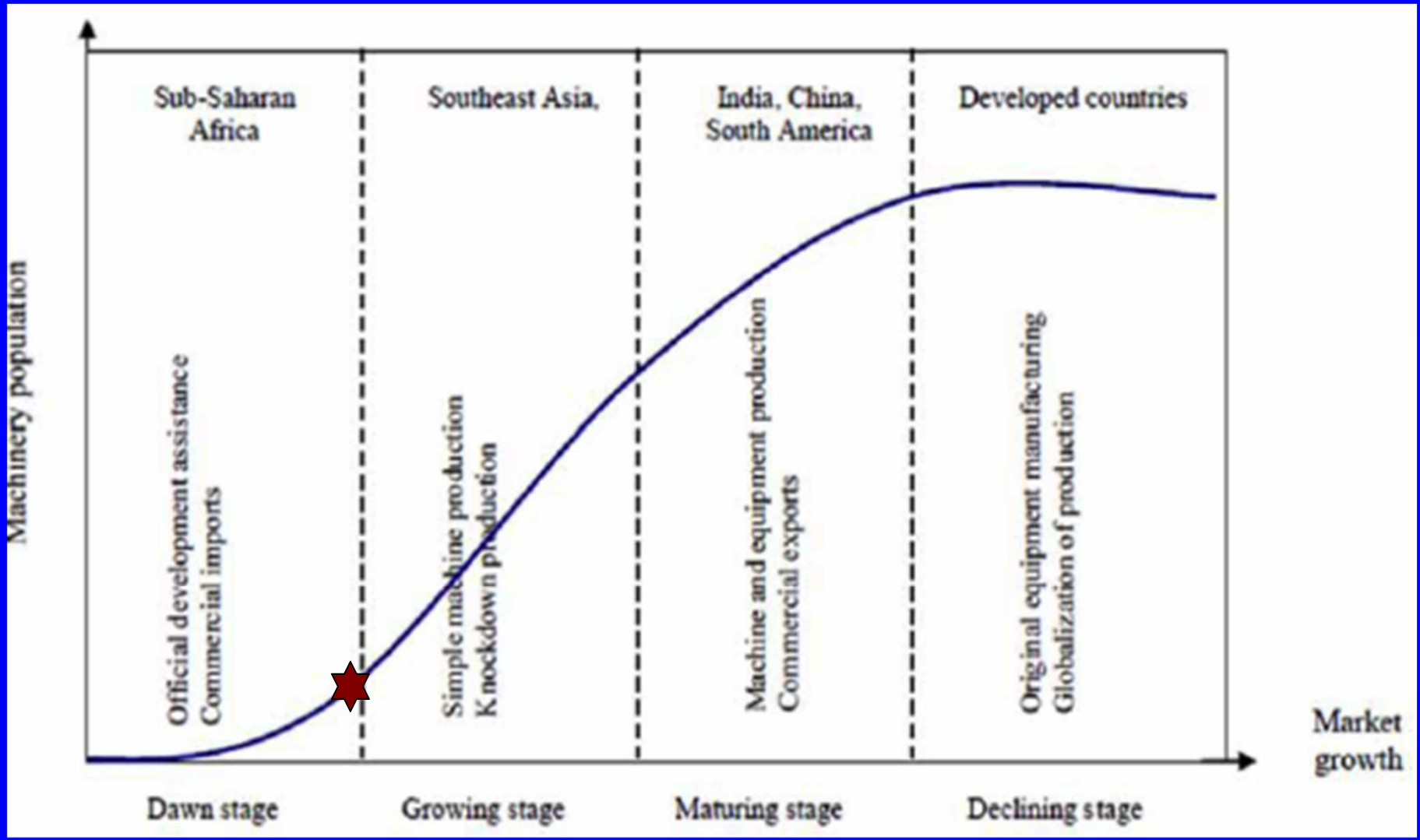
- Ghana will double rice production of the 3 major ecological regions being rain-fed upland, rain-fed lowland and irrigated land;

- It is feasible to have a rice cropping intensity of 1.5 in the rain-fed lowland and irrigated land areas. An intensity of 1.0 could be achievable in the rain-fed upland areas.

CURRENT STATUS OF AGRICULTURAL MECHANIZATION IN GHANA

- Sub-Saharan-Africa is characterized by persistent low levels of mechanization, about 1.3 tractors in use per 1,000 ha;
- Application of mechanization is to expand farming areas, to increase productivity and efficiency of agricultural production, to increase food security, to combat poverty, to improve income of the farmers and to sustain the rice production in Ghana;
- Only 20% of rice farmers growing rice as a cash crop can own tractor and agricultural machinery for their farming;
- Ghana government imported 10,000 tractors between the 1960s and the1980s. Most tractors were sooner or later abandoned as qualified operators, technicians and fuel were missing;
- In 2003, Ghana government imported machinery for individual farmers on a large scale;
- From 2007 to 2011, the government set up 89 public-private mechanization service centres (AMSEC) . Each of them took from 3 to 7 tractors in order to offer services to farmers;
- In total, the government imported 3,000 tractors in the last decade.

CURRENT LEVEL OF AGRICULTURAL MECHANISATION IN GHANA



Development stages of agricultural mechanisation in the world

(Source: Japan International Cooperation Agency –JICA)

PART II

AVAILABILITY OF AGRICULTURAL MACHINERY

LOCAL MADE MACHINERY OF GRATIS ENGINEERING DESIGN CENTRE

Mechanical products of Gratis Foundation

AGRICULTURAL MACHINERY IMPORTED FROM FOREIGN COUNTRIES

- Tractors of 65-70 HP and agricultural machinery (power tiller, rice reapers, rice threshers, rice mills) imported from Czech Republic, Japan and Indonesia for distribution to Ghana farmers

AGRICULTURAL MACHINERY IMPORTED FROM FOREIGN COUNTRIES

Rotary machine from Pavel Sálek

in Czech Republic

AGRICULTURAL MACHINERY IMPORTED FROM FOREIGN COUNTRIES

Rice reapers & threshers imported from Czech Republic

Japan rice thresher

AGROAFRICA

Tractors and agricultural machinery imported from Italy

RST COMPANY Ltd.

China seeder

China rice combine harvester

AFGRI GHANA Co. Ltd. (DISTRIBUTOR OF JOHN DEERE)

Disc plows & Disc harrow

+ The AFGRI Ghana. Com Ltd. was established in 2014.

+ The company has products like tractors from 42 to 65 HP (made in China & India); 3-disc. ploughes, disc. harrowers, till maize planters, rice seeders, etc.

+ After selling, the company provides 2-year (or 2,000 working hours) guarantee for tractors and 1-year guarantee for other agricultural machinery.

Spring cultivator & Disc ridger

Row crop cultivator

Three –disc plows

REPAIR & SUPPLY OF SECOND HAND TRACTORS IN EJURA

+ Ejura is the biggest area producing rain-fed upland crops such as maize, cassava, jam, bean, cow beans, etc. of the country. Therefore, it become the biggest mechanical servicing area for tractors and agricultural equipment of the country.

+ The workshop was established about 15 years ago. It has 15 non-skilled mechanics working for the workshop. It can do repair services up to 100 tractors /year.

+ It is also trading old tractors, about 10 old tractors/year.

+ There are only some welding machines & small cutting machines at the workshop, but no lathes and other big mechanical manufacturing machines. Therefore, it could not do big repair for tractors.

+ There are about 20 service mechanical workshops around Ejura has the same capacity as this workshop.

CAPACITY OF LOCALLY MECHANICAL WORKSHOPS

A locally mechanical workshop in Ejura

**** Summary:***

- Locally mechanical workshops are weak;

- Lack of necessary equipment & basic facilities, and well trained mechanics for maintenance and repairing of tractors & agri. machinery.

SUPPLY OF SPARE PARTS OF TRACTORS & AGRICULTURAL MACHINERY

- A shop of new spare parts of tractors and agri. machinery in Ejura. It can supply up to 90% spare parts.

- There are about tens new spare parts shops in Ejura.

Shops of second-hand spare parts in Ejura

GRATIS ENGINEERING DESIGN CENTRE (A TRAINING CENTRE OF AGRICULTURAL MECHANISATION)

- The training centre has quite enough basic equipment & facilities for training on mechanical techniques

A mechanical factory of Gratis Foundation

TRAINING CENTRES
ADIDOME FARM INSTITUTE



Disc plow & harrow



Rice reaper, Disc ridger, 4-wheel trailer & MF 4-wheel tractor

TRAINING CENTRES
ADIDOME FARM INSTITUTE

Demonstration of rice transplanting

- The training centre has quite enough equipment and facilities for training on agricultural mechanization.

- If the training centre is strengthened with qualified staff and advanced machinery & equipment, it will become a good training centre of the region.

EJURA AGRICULTRAL COLLEGE & MECHANIZATION CENTRE

- Most of machinery and equipment of the workshop are outdated or broken.

- The mechanization centre lacks seriously of qualified staff, lecturers, advanced equipment and facilities for training.

PART III

UTILIZATION OF AGRICULTURAL MACHINERY IN RICE PRODUCTION OF GHANA

LAND LEVELLING FOR RICE PRODUCTION IN GHANA

Small and fragmented rice fields in Bolgatanga

Due to lack of machinery, most of land for rice production in Ghana is still uneven, small and fragmented

Dried land leveling using big equipment for rice farming at GADCO farm in Fievie - Sogakope

SOIL PREPARATION
FOR DRIED & WET FIELDS IN GHANA

Soil ploughing in upland in Affife

Minimum soil preparation in lowland using rotary equipment in Affife

MANUAL RICE SEEDING & PLANTING IN GHANA

Direct broadcast seeding is the most popular for rice farming in Ghana

However, some areas applying manual rice planting; a case in Bolgatanga

SOME WRONG APPLICATION OF RICE COMBINE HARVESTER IN GHANA

One of three rice combine harvesters broken and left under the sun in Affife

APPLICATION OF RICE COMBINE HARVESTER IN GHANA

Recently, some combine harvesters imported for application into some rice producing areas in Ghana, especially in Volta region.

A rice combine harvester operating in Akuse of Volta region

PADDY RICE DRYING

Traditional sun-drying is still the most popular drying method for rice in Ghana – A case at Lartey farm in Akuse of Volta region

Recently, somewhere applied mechanized rice drying to ensure better rice quality - A column dryer of 25 tons of paddy/batch at GADCO farm in Fievie - Sogakope

PADDY RICE STORAGE

Bag storage is the most popular storage method of paddy rice in Ghana

2 silos with a total storage capacity of 1,760 tons at GADCO farm in Fievie - Sogakope

RICE MILLING

Due to small-scale rice production, mini rice mills are still popular in Ghana, causing high physical and quality losses for the rice – A rice milling site at Lartey farm in Akuse of Volta region.

A new application of rice processing line with capacity of 2.5 tons paddy/hour including pre-cleaning, husking, 3 stages of whitening, 2 stages of polishing, color sorting, drum sorting, weighing and packaging equipment newly built at GADCO farm in Fievie – Sogakope.

RURAL TRANSPORTATION IN GHANA

A power tiller mounted with a small trailer for rural transportation in Hohoe

SERVICE PROVISION OF AGRICULTURAL MACHINERY IN GHANA

- There are several service groups of agricultural machinery in Ghana;
- Services consist of soil preparation (ploughing & harrowing), seeding, spraying, rice cutting, rice threshing, or combine harvesting, etc.
- It is more profit in services for rice production compared with other crops.
- Soil preparation service price is 300-350GH₵/hectare for ploughing and 150-175GH₵/hectare for harrowing; harvesting service price using combine harvester is 800-1,200GH₵/hectare.
- Mode of service payment is also flexible, cash or product itself.

ORGANIZATION & ACTIVITIES OF GRIB

- The GRIB is a private organization established in 2004. At present, it has 20,000 members throughout the country;
- In the first stage of development, it has got financial supports from France and other NGOs;
- Organization and activities of GRIB are similar to those of a Ghana Farmers Association. It set cooperation mechanisms between different stake-holders in the rice value chain of Ghana to increase production efficiency and profit of the stakeholders;
- By guarantee of the GRIB director, members of GRIB can get loans with lower bank interests and longer terms from financial agencies for new investments in agricultural machinery;
- GRIB has service groups of agricultural machinery, rice processing plants. Members of GRIB can get services provided by GRIB at a cheaper price compared with other outsiders;
- Agricultural machinery of GRIB can expand their operation to different regions to increase number of working days per year;
- Therefore, GRIB is a right organization to cooperate and introduce agricultural machinery to farmers, and to scale up good models of agricultural mechanization service to rice production in Ghana.

POLICIES OF BANKS & GOVERNMENT TOWARD AGRICULTURAL MECHANIZATION

**** Policies of Banks:***

- Interest rates for loans are very high, ranging from 25%/year to 40%/year. Therefore, it is very tough for farmers to get loans for investment in agricultural machinery;

- Because of a lot of risks in agricultural production, most of banks are not eager in provision of loans to farmers;

- Procedures for getting loans are very complicated to farmers.

**** Policies of Ghana government:***

- The government has also good policies encouraging farmers to buy agricultural machinery such as subsidizing up to 30% of the machinery buying price;

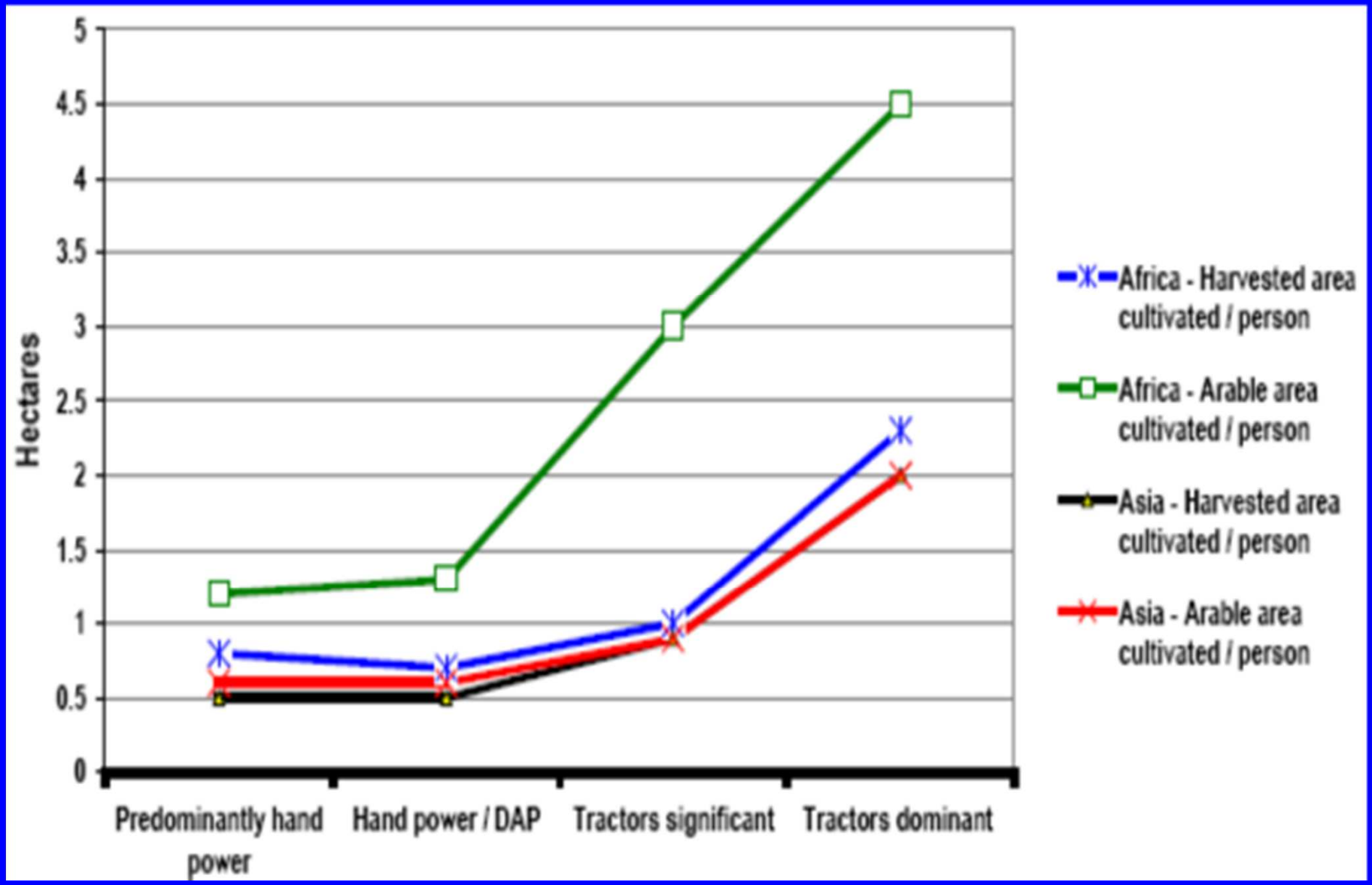
- For the project funded by Japanese government, when farmers take machinery from the project, they must pay gradually 50% of the total investment cost;

- After the initial stages, the farmers must pay higher for their investment in agricultural machinery, 70% of the total investment cost.

SUMARY OF ADVANTAGES & CONSTRAINTS, CHALLENGES FOR DEVELOPMENT OF MECHANISATION FOR SMALL RICE PRODUCERS IN GHANA

Advantages	Constraints/Challenges
Convenience in moving of machinery from places to places due to having few rivers in the regions	Mostly rain-fed farming, not much irrigated farming in many differently ecological zones throughout the country causing difficulties for adoption and adaptation of agricultural machinery/equipment
Mechanization in Ghana is at a certain level of agricultural mechanization	An unstable electricity network causing farming activities un-convenient and more expensive
	Small farms with uneven & fragmented land and few crops/year causing less efficient for operation of machinery
	A lot of labor force still being deployed to agriculture & rural areas
	Low investment capacity of rice farmers & very high interest rates of loans are main obstacles for mechanization in rice production
	Weakly mechanical workshops with shortage of skilled mechanics and well trained machinery operators in rural areas causing problems in operation, maintenance and repair of agricultural machinery leading to higher farming cost for rice productions
	A weak system of training centers of agricultural mechanization (lacks of qualified staff, advanced equipment and training facilities)
	Lack of information and awareness on benefit from agricultural mechanization
	High bank interest rate with short term loans
	Weak linkages between research institutes, development agencies, local fabricators and farmers
	A weakly agricultural mechanization extension system
	Lack of national strategies & strong policies towards farmers and agricultural mechanization

IMPACT OF MECHANISATION ON FARMING CAPACITY OF FARMERS IN ASIA AND AFRICA



(Source: FAO Agriculture towards 2015-2030 & FAOSTAT)

CONSEQUENCES OF LOW LEVEL OF AGRICULTURAL MECHANISATION IN GHANA

Low rice yield in uncontrolled water regions of Affife

Un-exploited low land areas of Affife

PART IV

RECOMMENDATIONS ON MECHANISATION FOR RICE PRODUCTION IN GHANA

AIMS OF MECHANIZATION IN RICE PRODUCTION IN GHANA

- To improve adaptability of agri. equipment to small farm sizes and fragmented land in Ghana;
- To save investment cost of machinery to improve acceptability of the rice farmers for new equipment/technology;
- To enable the rice farmers perform their farming operations efficiently;
- To increase capacity of local equipment fabricators;
- To suggest good business models for investments and up-scaling to service providers of agricultural mechanization;
- To increase income/profit of rice farmers, rice millers, agri. machinery service providers and other stakeholders of the rice value chain in Ghana;
- To create more jobs/opportunities for local/young people of Ghana.

CRITERIA FOR SELECTION OF AGRICULTURAL MACHINERY FOR SMALL-SCALE RICE PRODUCTION IN GHANA

1. Must be suitable to field sizes and soil conditions of each rice producing regions in Ghana → Apply small sizes or middle sizes of tractors and machinery;
2. Must be suitable to specific conditions of climate, weather, topography, soil type and other conditions of each ecological region in Ghana → The selected machinery should have high adaptability;
3. Must bring in higher benefit and profit to the investors, the users and the rice farmers compared with the traditionally manual farming methods → The selected machinery should have acceptable purchasing prices;
4. Should have shorter payback period and higher efficiency in investment → The selected machinery should be utilized for multi-purposes in rural areas;
5. Should be more convenient and easier in use, maintenance and repair;
6. Should be based on actual needs of the production, investment capacity , but not on subjective wills of political leaders.

CLASSIFICATION OF PRODUCTION REGIONS FOR MECHANIZATION APPLICATION

Based on specific conditions affecting directly application of mechanization such as physical soil properties, land & field sizes, topographic conditions, etc. of the 3 main rice producing regions in Ghana being rain-fed upland, rain-fed lowland and irrigated land; these regions could be classified into 2 main different regions for mechanization as follows:

A. Rain-fed upland: Uneven & slope land, dried soil with hard ground layer.

- 4-wheel middle-large size tractors of 50-70 HP with rubber wheels linked with large-middle size farming machinery can work more efficiently in larger land areas with field sizes of more than 0.1 hectares;

- 2-wheel tractors (or power tillers) of 10-16 HP with rubber wheels mounted with small farming equipment can perform more efficiently in smaller land areas with field sizes of less than 0.1 hectares or single remote fields.

The two types of tractors can work efficiently not only for rice farming but also for other up-land crops farming like maize, cassava, sugarcane, cowpeas, potatoes, etc.

- Dependent on field sizes, small, middle or large size self-propelled machinery such as rice reapers with cutting width of 1.2m, rice threshers with capacity of 1-2 tons/hour or rice combine harvesters with working width of 2.2 meters (capacity of 0.5 hectares/hour)with rubber wheels or tracks could be used.

CLASSIFICATION OF PRODUCTION REGIONS FOR MECHANIZATION APPLICATION (Continued)

B. Rain-fed lowland & irrigated land: More even & no slope land; low & wet soil with soft ground layer.

- 4-wheel small-middle size tractors of 30-50 HP with rubber wheels (or with steel cage wheels for muddy fields) mounted with small-middle size farming machinery can work more efficiently in larger land areas with field sizes of more than 0.1 hectares;

- 2-wheel tractors (or power tillers) of 10-16HP with rubber wheels (or steel cage wheels for muddy fields) linked with small farming equipment can operate more efficiently in smaller land areas with field sizes of less than 0.1 hectares or single remote fields;

- Small or middle size self-propelled machinery such as rice transplanters with 4 or 6 rows, rice reapers with cutting width of 1.2 meters, rice threshers with capacity of 1-2 tons/hour, rice combine harvesters with working width of 2.2 meters (capacity of 0.5 hectares/hour) using rubber tracks, etc. could be used .

MECHANISATION FOR RAIN-FED UPLAND RICE PRODUCING AREAS

RAIN-FED UPLAND RICE PRODUCTION AREAS

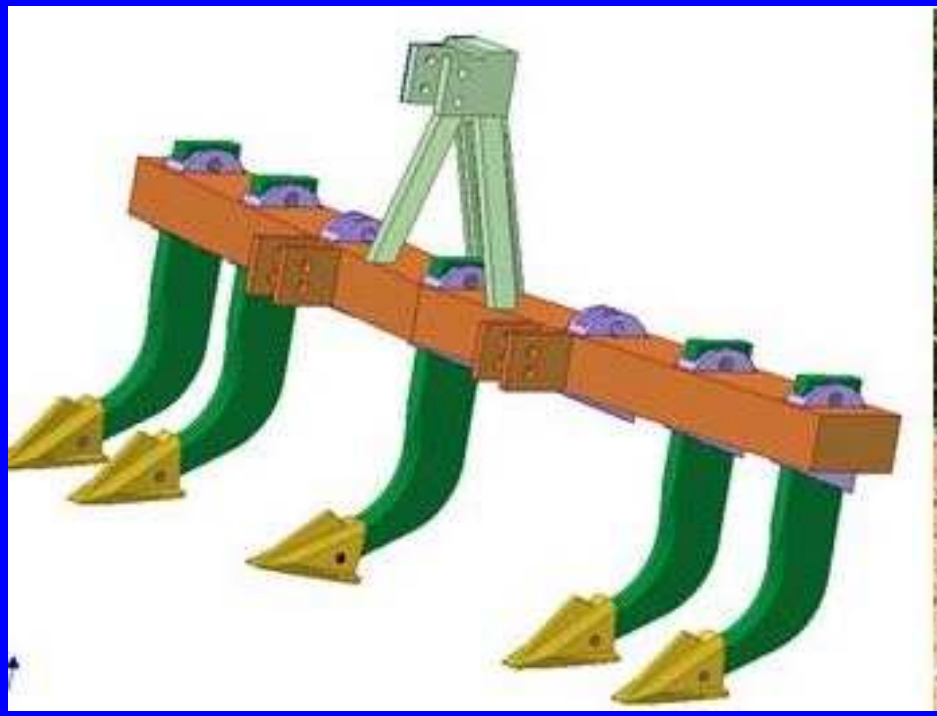
Rain-fed rice production in Konongo

Rain-fed upland areas occupy about 6% of the total arable area. Natures of the land are fragmentation, small field size, uneveness and with impediments

A rain-fed rice field in Ejisu

WASTE LAND WITH TREE ROOTS IN KUMASI

APPLICATION OF CHISEL PLOUGHS FOR TAKING OFF TREE ROOTS FROM WASTE LANDS



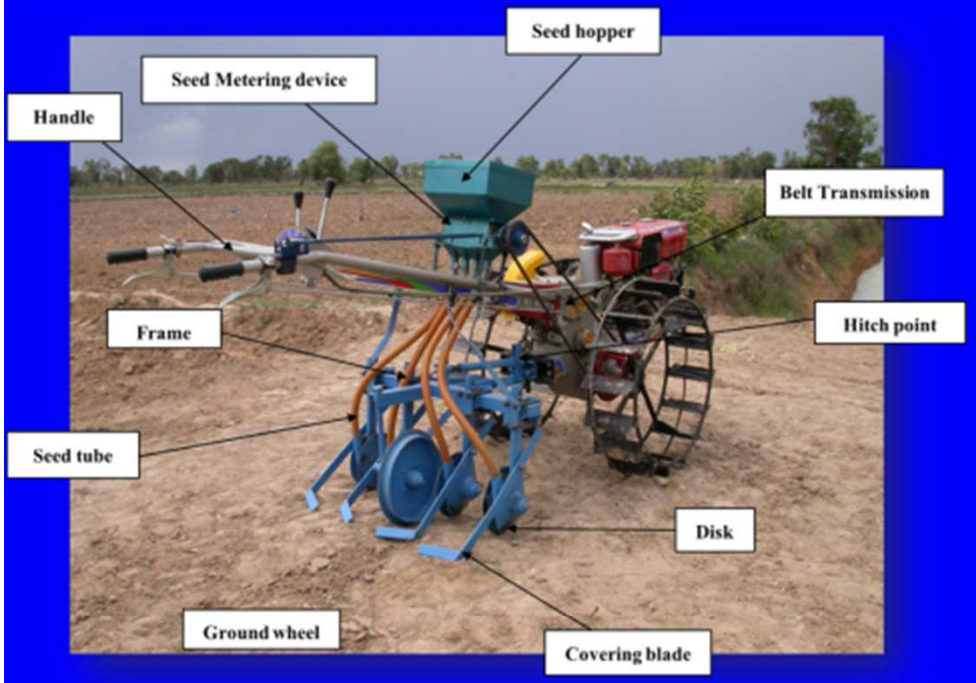
It is very important to clean up all impediments, especially tree roots from the field to make machinery more convenient & more efficient in operation. Big tractors with capacity of more than 60HP could be used with chisel ploughs.

APPLICATION OF MINIMUM SOIL PREPARATION

Rotary machine mounted behind 4 wheel tractors of 40 – 60 HP for dried or wet soil preparation

Rotary machine mounted behind 2 wheel tractors of 10 – 16 HP for dried or wet soil preparation in small or single or remote fields

TWO-WHEEL TRACTOR WITH
A PADDY GRAIN SEEDER FOR RICE DIRECT SEEDING



Utilize a row rice seeder mounted behind a 2-wheel tractor for up-land seeding

APPLICATION OF WATER PUMPS FOR RICE GROWING IN DRY SEASONS

Watering for rice fields in Balisie

Due to Volta lake crossing from the South to the North, rice land areas of dried seasons in the upland along the lake could be expanded much more by using water pumped up from the lake.

APPLICATION OF RICE REAPERS & RICE THRESHERS FOR SMALL & FRAGMENTED RICE FIELDS

Rice reaper operating in the field

Self-propelled rice thresher

MECHANISATION FOR RICE PRODUCTION IN RAIN-FED LOWLAND & IRRIGATED LAND

FRAGMENTED LAND WITH SMALL FIELD SIZE FOR RICE PRODUCTION IN BOLGATANGA

Irrigated land area occupying about 16% of the total arable area records the highest rice yields.

Rain-fed lowland area occupies about 78% of the total arable area, suitable for rice production but remains largely unexploited. It is estimated that Ghana has over 5 million hectares of unexploited rain-fed lowlands.

BASIC BENEFITS OF LAND LEVELLING IN RICE PRODUCTION

1. Save about 50% of water consumption for rice farming;
2. Increase 5% of land area for rice production due to reduction of field bands to maintain water level in the fields;
3. Make machinery more convenient and efficient in farming operations → increase capacity of machinery and reduce operation costs;
4. Can use the water level to control weed → minimize herbicide use;
5. Can apply fertilize more evenly → reduce fertilizer application;
6. Facilitate rice growing more evenly → increase yield and output of the rice fields and quality of the rice grains;
7. All the above reduce production cost of rice → improve income and profit of farmers;
8. Save energy and chemical consumptions → reduce environmental pollution.

FOUR-WHEEL TRACTOR WITH EQUIPMENT FOR WET & MUDDY LAND LEVELLING

4-wheel tractors of 30-50HP with steel cage wheels and a land leveler for wet & muddy land leveling

APPLICATION OF MINIMUM SOIL PREPARATION

Rotary machine mounted behind 4 wheel tractors of 30 – 50 HP for dried or wet soil preparation

Rotary machine mounted behind 4 wheel tractors of 30 – 50 HP with steel cage wheels for wet soil preparation

USING OF POWER TILLER
FOR MINIMUM SOIL PREPARATION IN SMALL OR REMOTE FIELDS

APPLICATION OF DRUM SEEDERS FOR ROW RICE SEEDING

Plastic drum seeders for row rice seeding

Row rice seeding reduces seed application, increases seeding capacity, better control of pests and diseases during rice growing and increases quality of rice grains. Besides, it can combine with fish or shrimp culture in the rice field to increase income and profit of the farmers.

Drum seeders mounted behind two-wheel tractor

STEP BY STEP APPLICATION OF RICE TRANSPLANTER

* Transplanting capacity: 200-500 trays/hour;
* Transplanting capacity: 25-30 times higher manual labors;
* Seed saving: Reduce 15-20 % compared with seed broadcasting;
* Better control of pest and diseases for rice field;
* Increase in rice yield: 15-20 %;

IMPROVEMENT OF SOIL STRUCTURE BY PLOUGHING EVERY 3 YEARS OF RICE CROPPING

Application of land ploughing in dry seasons for soil sun-drying to make the soil softer and more fertile for better rice root development and better rice growing.

7-disc plough

APPLICATION OF MIDDLE SIZE OF RICE COMBINE HARVESTERS

Kubota combine model	Unit	DC - 60
*Overall dimensions (LxWxH)	cm	480x217.5x280
* Dry weight	kg	2,450
* Cutting width	cm	182.80
* Cutting heights	cm	2 - 80
* Capacity	hec./hour	0.30 – 0.60
* Required power	HP	60

Carrier of paddy bags in the fields

For convenience & efficiency in harvesting; and minimum harvest losses of rice, rice fields should be drained out of water from 7 to 10 days before harvest.

A ”TWO IN ONE” COMBINE HARVESTER FOR RICE & MAIZE HARVESTING

With changible components of the same combine, a dual combine harvester can be used to harvest rice or maize

For rice harvesting

For maize harvesting

TRANSPORTATION OF COMBINE HARVESTER FOR EXPANSION OF ITS OPERATION REGIONS

The combine can be transported on roads, in rivers or canals from places to places to expand its operating regions in order to increase operation efficiency

ORGANIZING CONTESTS OF COMBINE HARVESTERS IN LARGE RICE PRODUCING REGIONS

APPLICATION OF FLAT-BED DRYERS FOR DRYING FRESHLY HARVESTED PADDY

USE OF RICE HUSK FOR FLATBED DRYER

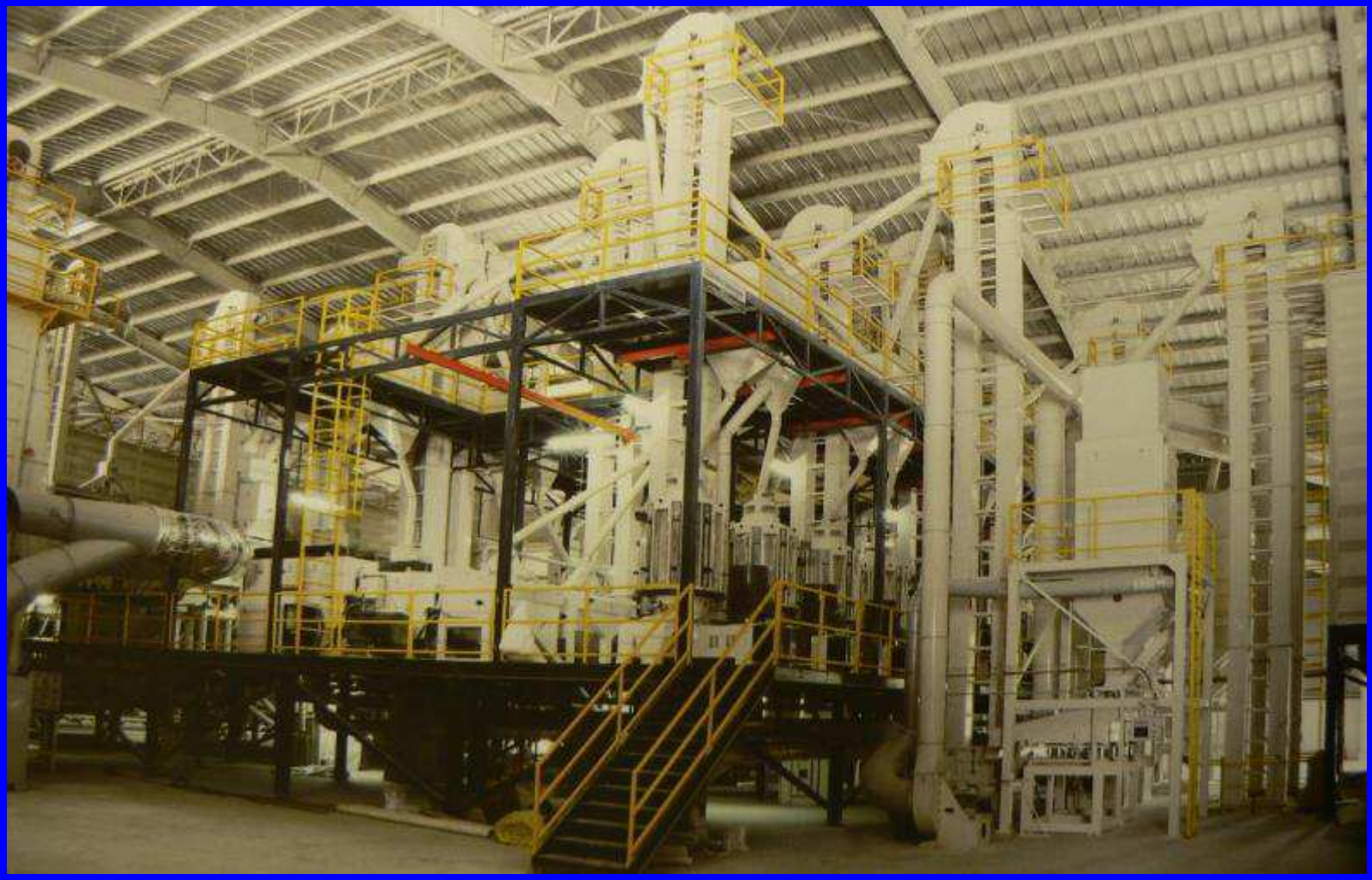
INVESTMENT IN COMPACT RICE MILLING LINES

(BUI VAN NGO MECHANICAL CO. - Vietnam)

Compact rice milling lines (CRM) with capacities ranging from 1 to 6 tons/hour

COMPACT RICE MILLING LINES

(BUI VAN NGO MECHANICAL CO. - VIETNAM)



Compact rice milling lines with capacities ranging from100 to 500 tons/day

OTHER POSSIBLE APPLICATIONS OF TWO-WHEEL TRACTOR WITH SMALL EQUIPMENT FOR SMALL OR MUDDY FIELDS

POWER TILLER WITH DIFFERENT MACHINERY/EQUIPMENT FOR UPLAND & WET LAND RICE FARMING IN GHANA












MODEL I
TWO-WHEEL TRACTOR WITH
TWO-BODY PLOUGHES

Dried soil ploughing in upland

Technical specifications:

+ Original countries: China, Thailand
+ Type: Two-disk plough
+ Model: 1LS-215
+ Number of disks: 2
+ Net weight of plow (kg): 40
+ Ploughing width (cm): 40
+ Ploughing depth (cm): 12-18
+ Required power: 2-wheel tractor of 12-18HP.

Wet soil ploughing in lowland using steel cage wheels

MODEL II
TWO-WHEEL TRACTOR WITH
SOIL HARROWERS

Technical specifications:

+ Original countries: Japan, Vietnam, China, Thailand

+ Type: Power tiller

+ Model: MK 120 (MK 120S)

+ Overall dimensions (LxWxH) (cm): 229x71x120

+ Weight without engine (kg): 257 (271)

+ Tilling width (cm): 600-750 (600)

+ Speeds:

- Forward: 6 speeds

- Reverse: 2 speeds

- Tilling: 4 speeds

+ Wheel tread (cm): 42-83

+ Required power: Diesel engine RV125-2 (LX), type: 4 cycle, 1 cylinder, horizontal position

- Weight of engine (kg): 105

- Rated output: 10.5 HP/2,200 rpm

- Max output: 12.5HP/2,400 rpm

- Cooling system: Radiator

Dried land harrowing

Wet & muddy land harrowing using steel cage wheels

MODEL III: RICE REAPERS

Technical specifications:

+ Original countries: Vietnam, China, Thailand
+ Type: Rice reaper
+ Overall dimensions (LxWxH) (cm): 199 x 190 x 110
+ Weight of rice reaper without engine (kg): 160
+ Cutting width (cm): 120
+ Cutting height (cm): 7-25
+ Cutting capacity (m^2/hr): 3,000 – 4,000
+ Required power: 4 Cycle – air cooled gasoline engine of 6.5-7HP/3,600rpm;
+ Fuel consumption (litre/hr): 0.7-1.0

Rice reaper in Africa

MODEL IV: MINI RICE THRESHERS

Technical specifications:

+ Original countries: Nigeria
+ Type: Axial rice thresher
+ Overall dimensions (LxWxH) (cm): 165 x 160 x 150
+ Weight of thresher (kg): 185
+ Threshing capacity:
a) 1,500 kg/hr; required power of 4 Cycle – water cooled diesel engine of 7 HP.
b) 2,500 kg/hr required power of 4 cycle – water cooled diesel engine of 15 HP.

Rice thresher of 1 ton/hour

MODEL V
TWO-WHEEL TRACTOR WITH
SELF-UNLOADING TWO-WHEEL TRAILERS

Technical specifications:

+ Original countries: China,
+ Type: Hydraulic self-unloading
+ Kind: Rear unloading
+ Number of rubber wheels: 02
+ Overall dimensions (LxWxH) (cm): 280 x 160 x 150
+ Size of carriage (cm):200 x 100 x 45
+ Weight of trailer (kg): 380
+ Transporting capacity (tons): 1.5
+ Max. transporting speed (km/hr): 25
+ Scopes of application: Plains, mountain areas, wet lands, rural areas, etc.
+ Required power: Two-wheel tractor of 12-18 HP.

Rural transportation in Vietnam & Thailand

OTHER SUPPORTING ORGANIZATIONS TO MECHANISATION FOR SMALL RICE PRODUCTION IN GHANA

ORGANIZATIONS PROVIDE FINANCIAL & TECHNICAL SUPPORTS FOR INVESTMENTS IN AGRICULTURAL MACHINERY

1. Sinapi Aba (a private financial agency)

- Sinapi Aba is a private financial agency providing farmers with middle term loans at interest rates ranging from 25%/year to 40%/year to invest agricultural machinery;
- The investors must have good records, enough capacity for repayment and other valuable properties;
- The investors have to sign an agreement with Sinapi Aba to provide agricultural mechanisation service to a group of farmers;
- Sinapi Aba has good cooperations with machinery distributors in selling their agricultural machinery to farmers.
- Distributors would share interest rate with investors of machinery in repayment.

2. GRIB

- GRIB is an extensive organization of Ghanaian farmers with more than 20,000 members throughout the country;
- It has also service groups of agricultural machinery and rice processing plants;
- It has good cooperation mechanisms between different stake-holders in the rice value chain to increase production efficiency and profit of the stakeholders in Ghana;

-Therefore, GRIB is a right organization to cooperate and introduce agricultural machinery to farmers, and to scale up good models of agricultural mechanization service to rice production in Ghana.

V. CONCLUSION

- The rice consumption in Ghana is 831,000 metric tons (2014) and it is estimated to reach 1,062,000 metric tons by 2020;
- Ghana is dependent largely on imported rice, about 400,000 tons/year, occupying about 52% of the total demand;
- Ghana has good climate and soil condition for development in agricultural production;
- There are 3 major ecological regions for rice production being rain-fed upland, rain-fed lowland and irrigated land;
- Rain-fed lowland area occupies about 78% of the arable area, suitable for rice production but remaining about 5 million hectares unexploited;
- Attraction of rural young labors by industrial zones & cities and expansion of rice producing areas motivated mechanization on rice production in Ghana;

CONCLUSION (Continued)

- There are several challenges and constraints for development in agricultural mechanization in Ghana: Low level of mechanization, un-skilled mechanics with back-ward equipment at locally mechanical factories, non-trained machinery operators; inefficient information provision, weak agricultural extension system and training centres; low investment capacity; and low effectiveness of national strategies and policies on agricultural mechanization;
- There are 2 main groups of agricultural machinery suitable to rain-fed lowland & irrigated land, and rainfed up-land rice producing regions in Ghana;
- Groups of agricultural machinery could bring in profit to not only the investors, the service providers but also the rice farmers compared with the traditionally manual farming methods;
- For a sustainable development in agricultural mechanization of Ghana, need to set up mechanisms for co-operations between various stakeholders in the rice value chain such as farmers/farmers groups/farmers associations, farm machinery service providers, farm machinery distributors, credit institutions and governmental organizations.

PART VI

RECOMMENDATIONS

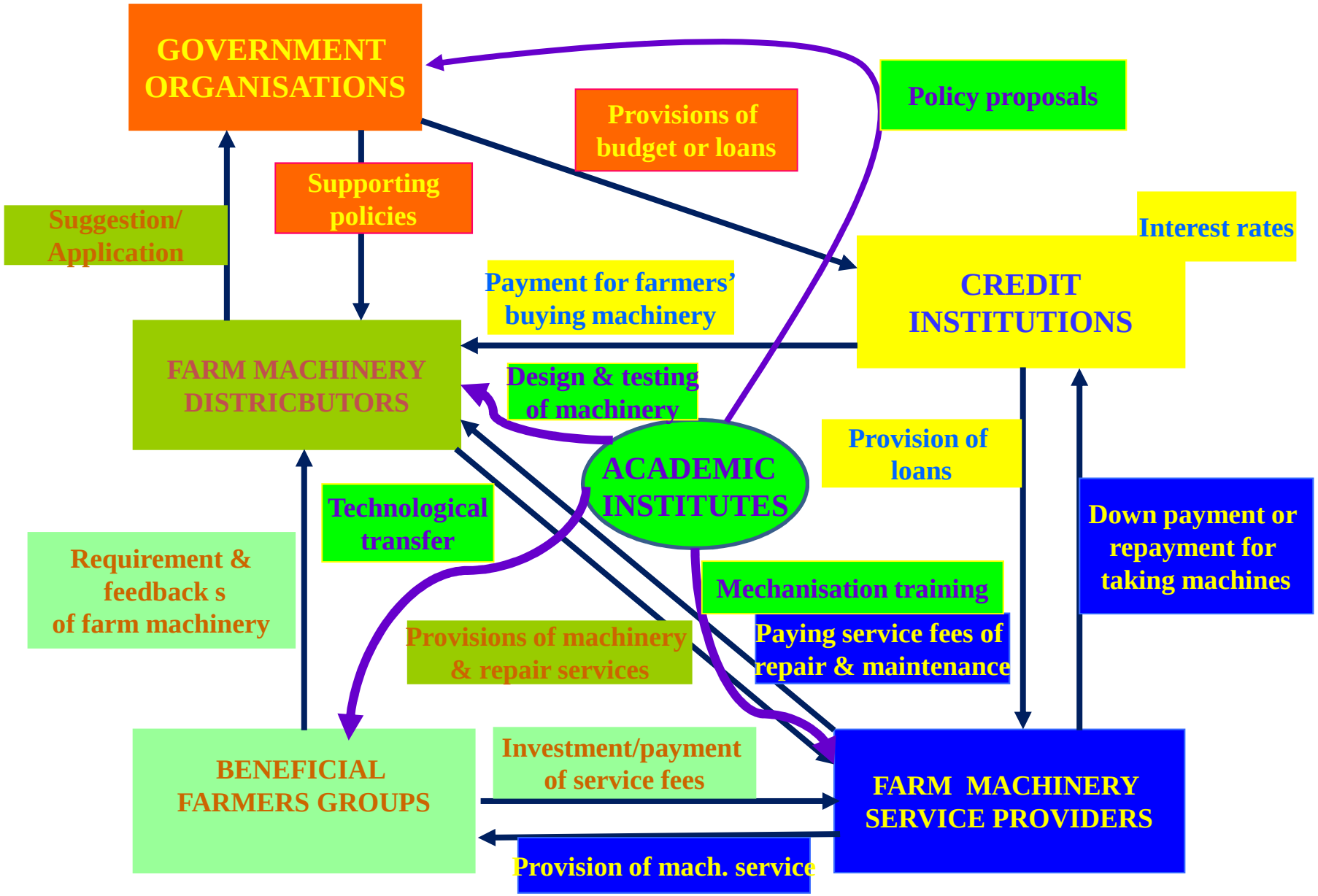
RECOMMENDATIONS TO THE CARI PROJECT

- Advise farmers and service providers to invest right machinery and set up appropriate business models for provision of agricultural mechanization services;
- Advise farmers and service providers to get soft loans from right credit institutions;
- Carry out field testings and demonstrations of the invested machinery for comparisons of economic and financial efficiencies between the mechanized farming models and the traditionally manual farming models;
- Advise mechanised service groups to organise them as shared holding companies;
- Send some key staff of the CARI project to Vietnam or Thailand for sharing experience on manufacture, maintenance and repair of farm machinery at locally mechanical factories and valuable lessons on development of agricultural mechanisation for small-scale rice production.

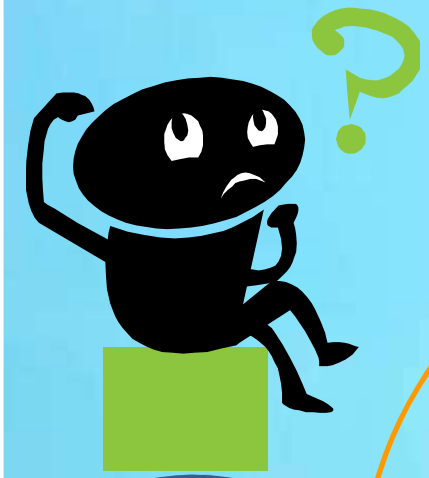
RECOMMENDATIONS TO THE GHANAIAN GOVERNMENT

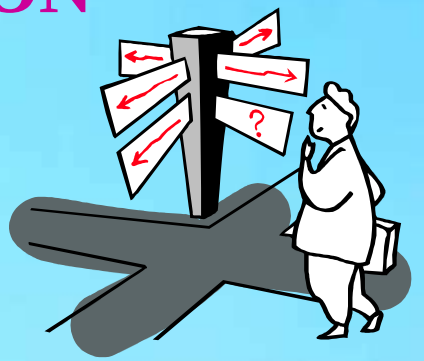
- Issue national strategies and policies for development in agricultural mechanization;
- Establish and strengthen mechanisms for co-operations between various stakeholders such as farmers/farmers groups/farmers associations, farm machinery service providers, farm machinery distributors, credit institutions and governmental organizations to encourage investments in agri. machinery;
- In the initial stage, provide partly financial supports to farmers and service providers for investments in agri. machinery;
- Strengthen agricultural extension centres, particularly mechanization divisions to introduce and provide technical support for users of agricultural machinery;
- Usually organize exhibitions, field demonstrations and contests for introducing agricultural machinery to farmers, potential investors and users;
- Strengthen training centres to provide training on usage, maintenance and repair of agri. machinery to service providers, farmers and other users;
- Strengthen locally mechanical factories for better services on maintenance and repair of agricultural machinery;
- Provide supports to R&D projects to study and apply machinery into agricultural production;
- Maintain better or newly invest in irrigation systems and water pumping stations for irrigating rice producing areas along Volta lake and Northern regions.

MECHANISM OF COOPERATIONS BETWEEN STAKE-HOLDERS FOR DEVELOPMENT IN AGRI. MECHANISATION OF GHANA



CO-OPERATIONS BETWEEN 4 MAIN PARTNERS IN RICE PRODUTION





Scientists

Rice Production

Farmers

Profit

Business

Market

Government

RECOMMENDATIONS TO OTHER RICE STAKE-HOLDERS

1. Farmers

- Participate training courses on rice production, crop management, rice quality and agricultural mechanisation for rice production.

2. Machine operators

- Participate training courses on mechanical techniques; skills in operation, maintenance and small repair of agricultural machinery.

3. Service providers

- Participate training courses on mechanical techniques, maintenance and small repair of agricultural machinery, and business management;

- Expand their services to not only both upland and lowland; but also inter-village or inter-provinces via local middlemen to increase annual working days of the machinery.

4. Agricultural extension agencies & training centres

- Strengthen their organization and services, particularly agri. mechanisation;

- Disseminate widely information of agricultural machinery and mechanisation to farmers and other stakeholders in the rice value chain;

- Conduct frequently training courses for farmers, operators and service providers;

- Organize frequently field demonstrations and contests on agricultural machinery to farmers.

THANK YOU VERY MUCH

FOR YOUR ATTENTION