

CHAPTER 5

AGRICULTURAL MECHANIZATION IN GHANA **- AN OVERVIEW**

by

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INTRODUCTION

The Ghanaian economy, like that of most other African countries, is primarily agricultural. Agriculture continues to account for roughly 50% of Ghana's Gross Domestic Product (GDP), and provides close to 70% of all merchandize exports. Over 66% of the population earn their livelihood from agriculture. A recent World Bank study on Sub-Saharan Africa concluded that "If Africa is to avert hunger and provide its growing population with productive jobs and rising incomes, its economies need to grow by at least 4 to 5 per cent a year The primary source of this growth can only be agricultural production " (IBRD (1989)) This primacy of agriculture in the economy is true for Ghana as it is for most of Sub-Saharan Africa. It is thus believed that the key to sustained economic development for Ghana lies in raising the productivity of the agricultural population.

Agricultural production may be increased by either cultivating more land, or by increasing the productivity of land under cultivation, or both. Whichever strategy is chosen, mechanization plays a vital role as a necessary component for supplying the needed impetus and input towards agricultural development and modernization. Ghana recognized this crucial role of mechanization early in her nationhood when she embarked upon large and rather costly mechanization schemes, and imported quite an array of agricultural machines in the 1962-1964 period. However, success has eluded the country in her mechanization attempts, and the problem now is "which way agricultural mechanization?".

HISTORICAL PERSPECTIVE

First attempts at mechanizing Ghana's agriculture were made in 1938 when the use of animal draught power was introduced in the Northern Territories of the then Gold Coast for the cultivation of groundnuts and cereals. However, interest in the scheme fizzled out soon thereafter, and the country had to wait till ten years later when in 1948/49 tractors were introduced in Damongo, also located in the Northern Territories, in a package under a Gonja Development Company. In 1950, the Ministry of Agriculture introduced tractors at some of its agricultural stations at Pokuase near Accra and Kwadaso near Kumasi in the Ashanti Region (Wadhwa, (1964); Gyarteng (1983)). Other agricultural

machinery were later introduced between 1952/54, and these included rice threshers, coffer hullers, and crop driers. A census of agricultural tractors taken in 1952 showed that there were 64 wheeled tractors and 6 crawler tractors in the country (Wadhwa (1964)). The 1952/54 attempt also fizzled out, until after Ghana's political independence when in 1962/63 the then Government in a bid to produce food and fibre for the increasing population and the nation's infant industries, embarked upon a bold scheme and imported into the country a large number of agricultural tractors and related implements.

The Government's policy on agricultural mechanization then as set out in Ghana's first seven-year development plan (1963-1969) (GoG (1962)) was to bring about a revolutionary change which would increase the cash incomes of farmers, and would meet the high demand for food and fibre in the economy, by getting away from the traditional cutlass and hoe shifting cultivation method of farming towards intensification and diversification of farm resources. The number of farming families was to be quickly reduced to one-quarter of its population within the plan period through the creation of large agricultural production units based on mechanization. Table 6 gives an inventory of farm machinery in the country during this period, and does indicate the level of mechanization introduced.

TABLE 6: ANNUAL TRACTOR POPULATION IN GHANA 1952-1969

Year	Wheeled Tractor	Crawler Tractors	Total
1952-1956	93	8	101
1961	115	9	124
1962	315	9	324
1963	1115	141	1256
1964	1865	351	2216
1965	2265	586	2851
1966	2965	736	3701
1967	3221	820	4041
1968-1969	3602	800	4402

SOURCE: MoA-GoG (1989)

Due to poor management resulting from inexperience and the rather high level of operations, coupled with lack of trained personnel, this attempt did not yield the anticipated results compared with the massive capital outlay. The programme resulted in an economic disaster with most of the imported machines soon ending up in agricultural machinery graveyards scattered all over the country as a result of breakdowns beyond repair (see Table 7). It is however noted that irrespective of its economic disaster, this 1962/63 attempt at mechanization succeeded in introducing a fairly high proportion of Ghanaian farmers to the potentials of mechanization in farming to the extent

that by the early 1970s some farmers, notably those in the savanna areas relied on tractors for the cultivation of rice, maize, sugar cane, tobacco and kenaf. To meet their machinery requirements, the Ministry of Agriculture's Mechanization and Transport Department used the remnants of equipment imported during the 1962/63 period to operate a Tractor Hire Service Scheme.

TABLE 7: INVENTORY OF AGRICULTURAL MACHINERY HELD BY MINISTRY OF AGRICULTURE - GHANA AS AT JANUARY 1971: NATIONAL SUMMARY

TYPE OF EQUIPMENT	SERVICEABLE	UNSERVICE- ABLE	SCRAP	TOTAL
Crawler Tractors	200	494	114	808
Wheel Tractors	385	988	866	2239
Ploughs	421	494	882	1787
Harrows	2552	297	236	3085
Ridgers	250	108	87	445
Cultivators	494	95	23	612
Planters	119	95	23	237
Seed Drills	108	141	40	289
Rice Combines	28	52	18	98
Corn Pickers	8	3	-	11
Rice Threshers	39	14	-	53
Rice Hullers	6	4	-	10
Maize Sheller	42	34	20	97
Grain Driers	17	10	1	28
Trailers	232	94	138	464
Miscellaneous	500	234	83	817

SOURCE: MoA - GoG (1971)

CURRENT TRENDS IN MECHANIZATION

Since the mid-1970's there has been a general desire by the Government to pull out of the tractor hiring service, with the hope of passing this job on to private entrepreneurs. It is clear that the Government Tractor Hire Service Scheme helped in developing farmers' interest in mechanization, as well as building up a nucleus of operators and maintenance staff. The advisory and administrative staff learnt what mechanization can do, what it costs and generally gained some experience necessary for the future. The Agricultural Mechanization and Transport Department of the Ministry of Agriculture has now been re-organized and renamed Agricultural Engineering Services Department, and has moved away from tractor hiring service. It now plays the role of an advisory and training entity. Through a recent proposal, it intends setting up a soil and water conservation unit within the department, which will be responsible for providing direct mechanical services to soil and water conservation ventures, and the construction of fish ponds and watering points for livestock and dry season gardening in the drier areas of the country.

TABLE 8: ANNUAL IMPORTATION OF WHEELED AGRICULTURAL TRACTORS AND COMBINE HARVESTERS 1973-1985

YEAR	WHEELED TRACTORS IMPROTED	COMBINE HARVESTER IMPORTED
1973	333	102
1974	760	66
1975	77	7
1976	137	-
1977	735	-
1978	873	-
1979	531	-
1980	371	-
1981	965	36
1982	716	30
1983	637	16
1984	353	N/A
1985	28	N/A

SOURCE: For 1973-1982 Figures by Gyarteng (1983). For 1984-1985 Figures: Provisional Figures supplied by Statistical Service, Accra.

To fill the vacuum created by the departure of the Agricultural Mechanization and Transport Department from tractor hiring, a number of fiscal policies and institutional arrangements have been formulated. These have come in the form of agricultural production packages which supply small-scale farmers with extension services, seeds and fertilizers, with mechanization as a component of the packages. Among such projects is Block Farms Limited, a subsidiary of Ghana's Agricultural Development Bank, the Upper Regional Agricultural Development Project (URADEP) in the Upper Region, the Volta Regional Agricultural Development Project (VORADEP) at Ho in the Volta Region, and more recently the Ghana/FAO/Italy Afram Plains Mechanization Programme located at Donkorkrom in the Eastern Region, and the Global 2000 Project which is nationwide. All these projects are run with foreign loans or grants and have agricultural mechanization components. Additional to these regional projects, joint-venture projects involved in large-scale production of cereals have been established in certain localities. These engage in large-scale fully-mechanized farming. Some have been very successful, others have not survived. Among these ventures may be mentioned the Ejura Farm Ltd., at Ejura, and the Kumawu Industrial Farm Complex (KIFCOM) Kumawu, all in the Ashanti region.

Other users of agricultural machinery are the farmers located at the various state-owned irrigation project sites. These farmers produce rice and vegetables on a hectare piece of irrigated land. The package here includes the provision of tractors and other farm machinery, mostly for primary tillage. Table 8 shows imports of tractors into the country for the 1973 - 1985 period. It is noted that whilst figures of tractor imports fluctuate, there has been

generally persistent increase in the importation of tractors into the country over the years, especially during the late 1970's and early 1980's. The average annual number of tractors imported is around 700 units, with the exception of 1975-76 when economical and political problems affected the level of importation.

LEVEL OF AGRICULTURAL MECHANIZATION

The greatest demand for mechanization among the small-scale Ghanaian farmers is for land preparation, especially ploughing. This is attributed to the seasonal shortages of labour, and the need for timeliness of operation. Labour is also expensive. Availability of tractors for hire is limited, and this limits the area which can be prepared at the appropriate time. The common choice of equipment is a standard 30-50kw four-wheeled farm tractor, complete with 3-furrow disc plough, a disc harrow (off-set or tandem) and a 3-5 tonne trailer. Some farmers just double plough and plant without harrowing. This is common among farmers who grow maize. The use of single-axle pedestrian tractor (or the power tiller), complete with a rotovator is popular among the rice growing farmers on the irrigation sites in the Southern part of the country. Mechanical seed planting is practised mainly by the large-scale farmers, and hardly by the small-scale farmers. Very few farmers do row-cropping, and consequently cultivators are rarely used for weed control. The use of sprayers, especially the knapsack sprayers, has been popular, especially among the country's cocoa farmers. These cocoa farmers use the knapsack mist blowers for the control of capsid disease and mealybug attack. This has been specially promoted and subsidised by the Ghana Cocoa Marketing Board over the past three decades, mainly because of desire to maintain increased production of cocoa, the country's number one foreign currency earner. The use of crop sprayers among farmers who grow food crops is limited to a few vegetable growers, but again the popular models are the knapsack sprayers rather than the tractor-operated boom sprayer. Fertilizer application is generally done by manual broadcasting and drilling is hardly practised.

The use of combine harvesters is also limited to the large-scale farms producing maize and rice as monocrops, and combines are rarely used by the small-scale farmers who mostly practise mixed cropping. The low use of combines by the small-scale farmers is also explained by the limitations imposed by small size of their farms, and by the fact that most of the common staples like plantains, yams and cassava which are usually cultivated do not easily lend themselves to mechanical harvesting. Tractors play a vital role in rural transportation. Most of the access roads to the food producing areas are in poor condition during the rainy seasons and tractors are the only means of transport to ferry the farm produce to the marketing centres. This is one area where tractors are intensively used during off season and is rarely considered in many economic studies but is crucial to the profitability of the entire agricultural system as well as a means of earning extra revenue by tractor owners.

Use of draught animals

Many farmers in the Upper and Northern regions of the country have traditionally been using bullocks for farming. In recent years the limited availability of tractors for hire, coupled with rising costs, has led to an increase in the number of bullocks used in mechanized farming. Unfortunately, there are no data on the number of oxen currently being used for draught purposes and evidence of the spread of the use of draught animals in agriculture has only come from subjective observations by extension officers and the demand for ox-ploughing training centres (NORRIP (1982)). The main reason for using bullock traction technology has been the need to overcome seasonal labour shortages for land preparation rather than a desire to increase land under cultivation. This is substantiated by data which shows that the average area cultivated per one adult is not greater in households using bullocks than in households using the traditional hoe and cutlass. The explanation for this situation appears to come from the fact that the weeding and crop harvesting aspects in the crop production process have still not been mechanized and these operations become serious bottlenecks when cropped lands are expanded using bullock ploughing. It is unlikely that the numbers of farmers in Ghana using draught power is that significant. Panin (1990), for example casually estimates that about 20% of the farmers in North Eastern Ghana use draught oxen for ridging. It is significant also that Ghana is not a member of the West African Animal Traction Network (Starkey and Ndiame (1988); Starkey and Faye (1990)).

Crop processing

One area of success in the food production chain in so far as mechanization is concerned is that of primary processing of staple foods and oils. The use of locally fabricated grain threshers for rice, cassava graters, palm fruit digesters, palm kernel crackers, poultry feed mixers and a few other mechanical equipment is now fairly common and this is assisting in mechanizing food preparations, and helping rural women in their daily chores. Most of these equipment have been locally designed and fabricated. The exact production figures are difficult to determine, what is clear is that it is rare to see farmers and women in households using the traditional handtool methods in performing these tasks. This is perhaps one example of successful mechanization which has not been documented and useful lessons may be learned if research is undertaken to determine why these devices have spread so fast in Ghana.

CONSTRAINTS TO AGRICULTURAL MECHANIZATION

The whole process of agricultural mechanization is influenced by both the economic and social systems in Ghana, and is affected by both push and pull factors within and outside the agricultural sector. The core push factor is the supply of good quality machines at reasonable prices, and Government's

assistance through financial and institutional arrangements which help to accelerate the adoption of machines by farmers. The pull factor or demand for agricultural machinery may be considered as a function of time saving; yield increase; ratio of machinery cost to farm produce price; the ratio of machinery costs to costs of substitutable inputs; reduction in drudgery of farm work with machinery; and expected psychological income from owning machinery. The relative importance of each of these variables differs with time and among farmers, but generally national policies should be seen to positively favour these factors. In Ghana the promotion of agricultural mechanization goes beyond the Ministry of Agriculture, and involves the Ministries of Finance and Economic Planning, the Ministry of Industries, the Ministry of Fuel and Power and the Labour Ministry. These sectoral ministries should necessarily work together to ensure the creation of the right atmosphere for mechanization.

The major constraints to agricultural mechanization which can be cited include, inter alia

(i) ***Problems of Provision of Basic Equipment and Services***

The Government has since the 1970's gradually been decreasing its involvement in the tractor hiring service with the hope that the private sector will take up the provision of such services. Unfortunately the private sector has not been able to provide the needed machinery in adequate numbers. To activate and ensure progress in this direction, the private sector would have to be expanded to identify entrepreneurs or farmers' groups who will operate successful commercial machinery hire service. Such entrepreneurs will require technical assistance in managing their tractor fleets.

(ii) ***High Cost of Agricultural Machinery***

The cost of machinery is unreasonably high to the extent that very few farmers can afford to own any farm machinery. In addition current bank lending rates at between 25-33% are high and scare away prospective entrepreneurs and farmers from seeking financial help from the banks.

(iii) ***Lack of Mechanization Extension Services***

The majority of the extension officers in the country concentrate more on the agronomy aspects of crop production and hardly on issues relating to mechanization. Their knowledge of agricultural mechanization technologies is also limited. This leaves the farmer totally ignorant as to what should be done when it comes to mechanization issues.

(iv) *Problems of Mechanization of the Basic Staples*

Whilst the production of most of the cereal crops such as rice, maize and sorghum, and some legumes can be easily mechanized, there is still the problem of mechanizing most of the local staples including cassava, yams and plantains. Solution here calls for sustained research on mechanizing production of these crops. Meanwhile, an attempt should be made at mechanizing certain tasks connected with the production of these staples through selective mechanization or task mechanization.

(v) *Lack of Long-term Mechanization Programmes and Strategies*

Following the low economic returns which characterised Ghana's first mechanization attempts in the 1960's, succeeding Governments have become reluctant to get directly involved with agricultural mechanization, or even to pursue policies which would accelerate the adoption of more agricultural field machines by farmers. It seems the country has opted for the 'no strategy' approach for mechanization, with the hope that mechanization will automatically come when conditions are ripe for it. The few major production ventures which were using agricultural machinery for the production of such crops as sugar cane for the country's sugar factories and the large-scale rice farmers at Tamale which characterized the Operation Feed Yourself Campaign are all operating on limited capacity now. Consequently, except for the special projects mentioned earlier, the use of farm machinery by individual farmers is rather limited.

TRAINING AND EDUCATION

Provision of adequate educational and training facilities, including qualified instructors, is an important pre-requisite for mechanized agriculture. Education, training, research and extension activities become essential when mechanization is introduced into a predominantly traditional peasant agriculture. The shortage of skilled personell in Ghana coinciding with the sudden introduction of tractorization in the early 1960's was serious. Unlike the situation in most European and other countries in the world, agricultural mechanization in Ghana was introduced in a revolutionary way rather than by evolution. There was therefore the need to train "everybody", and, consequently to provide for education at all levels on the operation, maintenance and repair of tractors and field equipment, otherwise the heavy investment in equipment would have gone to waste. Education was to include orientation of the farmer to the use of improved farming practices in conjunction with tractor use, and this was to cover fertilizer application,

irrigation farming and changing of certain cultural practices. Machinery operators, mechanics, technical staff and administrative personnel also had to be trained to properly handle and manage the imported equipment and it was hoped this would lead to profitable farm mechanization.

The initial strategy adopted in Ghana was therefore aimed at building a corps of trained personnel capable of running and maintaining imported equipment through accelerated training programmes which were practical in scope and sacrificing much theory, but providing experience through field practice in the proper use and operation, maintenance and repair, including the use of manuals. This was to be followed by plans for more intensive formal training to provide theory and knowledge in agricultural mechanization, resulting in the production of supervisory grade personnel and professional agricultural engineers, well-versed in the theory and knowledge of mechanization. Like in other developing countries, Government educational and farming programmes to accomplish the above goals have been the most prevalent.

The various Government agencies charged with the operation and maintenance of the imported equipment, (e.g. the United Ghana Farmers Cooperatives Council, the Volta River Resettlement Unit, the Division of Irrigation, Reclamation and Drainage, etc.) all initiated training programmes which recruited and converted truck drivers to tractor operators, and vehicle mechanics to farm machinery mechanics. By 1966 the engineering wing of the Ministry of Agriculture, the Agricultural Mechanization and Transport Department which had taken over the activities of the United Ghana Farmers Cooperative Council (UGFCC) had 1,500 tractor operators and 600 tractor mechanics on its pay roll.

Farm mechanization schools were later established at vantage points in the country at Navrongo in the Upper East Region, Nyankpala in the Northern Region, Ejura in the Ashanti Region and at Ohawu in the Volta Region, with technical assistance from the USAID. The USAID supplied inputs, together with experts, whilst the Government of Ghana contributed buildings and other physical infrastructure and counterpart staff. In 1970 USAID withdrew from this training project, and due to lack of support, these well-equipped and organized establishments deteriorated quite fast. Equipment were abandoned because of lack of spare parts and the local staff were absorbed by other organizations. (Ewusi *et al.* 1974) Now farm mechanization has become part of the syllabus of all Agricultural Colleges in the country.

However, to maintain the momentum in training, started in the early 1960's, the Government of Ghana, in 1968, received technical assistance from the FAO and agricultural engineers were posted to the Ministry of Agriculture, with duties which included on the spot advice and training of personnel, programming of work selection and correct utilization of farm machinery and general advice on farm mechanization. These engineers helped to re-train

mechanics, operators and farmers through in-service training programmes between 1968-1975. Technical personnel and managers, including professional agricultural engineers and supervisors, were in the meantime, trained in overseas institutions as there were no training facilities then in Ghana. Institutions for training this upper grade personnel for mechanization have been established in the country and since the early 1970, most of the needed personnel are currently locally trained. Table 9 shows a list of training programmes in agricultural mechanization offered in Ghana.

TABLE 9: INSTITUTIONS IN GHANA OFFERING FORMAL TRAINING PROGRAMMES IN AGRICULTURAL MECHANIZATION

NAME OF INSTITUTION	TYPE OF TRAINING	PRODUCTS
Asuansi Technical Institute	Agric. Mechanization Mechanic Course	Mechanization Mechanic
Tamale Polytechnic	Agric. Mechanization Technician Course	Mechanization Technician
Ho Polytechnic	Agric. Mechanization Technician Course	Mechanization Technician
Chawu Agric. College	Post-Secondary Agric. Mechanization Technical Officers Course	Technical Officer (Extensionist)
University of Ghana, Faculty of Agric., Agric. Engineering Section	National Dip. in Agric. Mechanization	Senior Technical Officer
*University of Science and Technology, Kumasi, Mechanical Engineering Department	Higher National Dip. in Mech. Engineering with Specialization in Agric. Mechanization	Engineering Technician
University of Science and Technology, Kumasi. Agric. Engineering Dept.	4-year BSc programme in Agricultural Engineering	Professional Agricultural Engineer

Beside the above, the three University Faculties of Agriculture at Legon, Cape Coast and Kumasi offer specializations in agricultural mechanization in their undergraduate agriculture programmes. These agricultural mechanization majors, though not educated as engineers, are however in a position to render competent and substantial services in agricultural engineering, because of the course-work that they complete in order to obtain the BSc. degree in Agriculture. Post-graduate programmes in Agricultural Engineering, preferably after two to four years employment, does convert them to the professional agricultural engineers status.

The training of farmers is now done at the Farm Institutes run by the Ministry of Agriculture at Wenchi, Asuansi, Damongo, Navrongo and Ejura. Formal training and re-training of tractor operators and mechanics takes place at Ejura Agricultural College and as components of some foreign-assisted agricultural projects initiated by the Ministry of Agriculture. Examples of such projects are those at Atebubu Agricultural Station, Somanya Agricultural Machinery Centre, and the Ghana/FAO/Italy Agricultural Mechanization Project based at Donkorkrom and Tamale. The various agricultural machinery dealers also train operators and mechanics and render after-sales services to machinery owners. It is believed that the annual output from these various training institutions is enough to satisfy current demands of personell for agricultural mechanization in the country.

AGRICULTURAL MECHANIZATION RESEARCH AND EXTENSION ACTIVITIES

Research and Development activities are important requirements in the build-up of local technological capabilities not only in the production of machinery needed to promote and sustain agricultural mechanization, but more so to understand local environment in the natural, technical, economic and social context. A continuous R and D effort and efficient use of human resources and technical inputs are essential pre-requisite for sustainable development of mechanization. There is ample demonstration in the developed nations, and even in Ghana (see Table 10) to show that machine use increases production and decreases labour requirements. Nonetheless, the scope of machine use in Ghanaian agriculture still remains an unanalysed and controversial issue owing to the absence of specific knowledge of agricultural mechanization factors resulting from the low priority given to agricultural mechanization research at the national level. Most of the research efforts undertaken to increase agricultural production in Ghana have been concentrated on the inputs of high yielding crop varieties, fertilizer use and pest control, with very little attention given to farm power and implement innovations and their effects on production. Research, if any at all, in the field of mechanization is scattered and cannot form any basis for major policy decisions on mechanization. The possible role of mechanization in Ghana is yet to be evaluated in a comprehensive manner.

This does not however mean that agricultural mechanization practitioners in Ghana do not know what needs to be done. It is rather to be contrary. For as far back as 1964 (Ewusi *et.al.* 1974), there have been repeated calls for systematic research into such important mechanization areas as:

- (a) research to determine what factors favour adoption of mechanization technologies by the small farmer and what are the constraints which prevent him from moving faster toward higher levels of mechanized agriculture.

- (b) testing, selection and modification of machinery to suit different jobs and purposes, from both technological and economical points of view;

TABLE 10: EFFECTS AND PROFITABILITY OF MECHANIZATION AND IMPROVED TECHNOLOGY ON YIELDS OF SELECTED ANNUAL CROPS IN GHANA

COMMODITY & PRODUCTION SYSTEM	YIELD KG/HA
<u>Rice</u>	
Traditional	1000
Improved Technology (seed & fertilizer)	1400
Modern (fully mechanized with seed & fertilizer)	1800
Small-Scale Irrigation and Mechanized	4500
<u>Maize</u>	
Traditional	1000
Improved Draught	2500
Modern (Mechanized, Seed & Fertilizer)	3000
<u>Sorghum</u>	
Traditional	700
Improved Technology	1800
<u>Cotton</u>	
Semi-Traditional	550
Improved Draught	1200
<u>Cassava</u>	
Traditional	3000
Improved Draught	5000
Modern (Mechanized, Seed & Fertilizer)	10000

SOURCE: Adapted from Ghana Medium-Term Agricultural Development Programme Table 4.1 by World Bank, Agricultural Operations Division, Western Africa Department, Africa Region December 15, 1989;

- (c) research aimed at improving existing production methods and developing new techniques of mechanizing the various production processes, including modifications in farming practices to enhance the utility of machines and implements;
- (d) research into selecting and breeding of crops suitable for mechanization, e.g. with regards to uniformity of height of plants and ripening to make use of mechanical harvesters, etc.

- (e) research to find answers to the serious technical problem of maintenance of soil fertility and conservation of soil and water in the tropical rain-forest belt with its high rainfall, high temperatures and generally thin topsoil.

Thus, there are a lot of areas in which research could be undertaken on agricultural mechanization in Ghana.

One successful research output, however, stands out. This involved the system of land capability classification based on the degree of limitation of the soils of Ghana to mechanized farming and management which had been worked out by the Soil Research Institute, of the Council for Scientific and Industrial Research (CSIR) (Obeng and Smith (1964)). It is unfortunate that this valuable research output has generally been ignored, and mechanization schemes continue to be located in particular areas on the basis of political motives. The Agricultural Engineering Services Department of the Ministry of Agriculture has occasionally conducted field trials and adaptability of agricultural machines being introduced in Ghana. This formed part of the research and extension activities of the department, especially in the 1970's but activities in this area have now declined due to financial problems and more so due to the absence of a centre with basic facilities to undertake the trials.

The few R and D activities currently going on are found mainly in the universities where research efforts are directed at machinery development for crop storage and processing, and to tillage and other general mechanization topics to a limited extent. Output from these research efforts has been rather low and their impact not much felt. Thus one sees a general lack of sustained research effort in the field of agricultural mechanization in Ghana, and this calls for an urgent need to address the issue seriously. The main constraint has been the lack of purpose and direction, with each small unit doing its own thing. In this regard one cannot but add one's voice to the call for the establishment of a National Institute of Agricultural Engineering which will be the focal institution for a systematic and concentrated research in all aspects of agricultural engineering, including mechanization.

Mechanization Extension Activities

Upto 1988, the main Government institution which was charged with agricultural mechanization extension activities was the Agricultural Mechanization and Transport Department of the Ministry of Agriculture. This had a core of technical officers who provided extension services to farmers on agricultural mechanization issues. Efforts of these specialist personnel were supplemented by other public organizations such as the Grains and Legumes Development Board, the Cotton Development Board and other Non-Governmental Organizations such as the Christian Service Committee who were training farmers on the use draught animals. Following the re-organization of the Ministry of Agriculture, a Department of Agricultural

Extension Services has been created, and charged with the responsibility of handling all the agricultural extension activities of the Ministry. The Agricultural Extension Services Department is thus the front line contact between the farmer and the various specialist departments of the Ministry of Agriculture, including the Agricultural Engineering Services Department as well as being the liaison between the farmer and research institutions. The NGO's and the quasi-government institutions however still operate independently of the Government system.

ROLE OF EXTERNAL DONOR AND DEVELOPMENT AGENCIES

Ghana has received considerable support from external donor and development agencies in her quest to mechanize her agriculture. Foreign assistance has come from individual countries and international development agencies like the FAO, UNIDO, USAID, CIDA and GTZ to name a few. This has come in the form of direct donations of machinery and equipment, participation in mechanization projects, supply of experts for training and advice in mechanization. A few countries have been involved in providing technical assistance for the education of national mechanization experts and in the establishment of training facilities for professionals; and in the local production of farm implements, especially for bullock farming. Continuing-education opportunities have been provided by some of these external donor and development agencies for Ghanaian experts and professionals through sponsorship to international workshops, seminars and symposia.

DEMAND AND SUPPLY OF AGRICULTURAL MECHANIZATION INPUTS

Shortage and high cost of labour have been identified as two of the major constraints limiting increased agricultural output in Ghana. Current national policies relating to agricultural development in Ghana emphasize the need for significant increment in agricultural production. The production activities contained in all the agricultural programmes for the 1990's through to 2000 as set out in the Medium Term Agricultural Development Programme (MTADP) (MoA-GoG (1989)) and the draft proposals of the National Science and Technology Plan (1990-1995) (CSIR (1990)) all show changes in the total requirement and in the sources of power which will result from:

- expected expansion of total cropped area
- utilization of water resources for agricultural purposes
- changed cropping pattern, and
- expected change in the technology level.

Table 11 shows the total demand in Ghana for food, feed and industrial raw materials of the major agricultural products, for the years 1987, 1995 and 2000, whilst Table 12 gives current levels of production of cereals and some of the important crops. Whilst a proportion of the total demand will be met by

imports, the various programmes mentioned above call for growth rates of about 4% per year in local production to be achieved over the plan period, and this necessarily requires expansion of cropped area over and above current levels.

It is envisaged that area expansion for vegetables, rice, tobacco, cotton and some tree crops, estimated to be of the order of 2.5 per cent per annum, will play a crucial role and is considered as the main prospect for improving rural incomes.

TABLE 11: TOTAL DEMAND FOR FOOD FEED, AND INDUSTRIAL USE IN GRAIN EQUIVALENTS (METRIC TONS)

	<u>1987</u>	<u>1995</u>	<u>2000</u>
CEREALS, Total	822288	1210619	1546585
Wheat	75696	116809	153189
Rice	88976	232253	169430
Maize	406136	611089	793392
Millet	109272	152393	187608
Sorghum	142208	198530	244564
NON-CEREALS, Total	1510016	2245859	2881918
Cassava	599008	894700	1153333
Yam	173968	258231	330537
Cocoyam	355904	527710	675009
Plantain	312080	468856	604675
Groundnut	69056	96563	119073
TOTAL FOOD CROPS	2332304	3456478	4428503
LIVESTOCK			
Meat:	47808	72488	94039
Cattle	17264	26154	33907
Poultry	9296	14552	19255
Others	21248	31783	40877
Eggs	6640	10083	13090
Milk	13280	21954	30057
SUGAR	34528	53151	69597
VEGETABLE OILS	92960	137627	175877
FISH	171312	252724	322243
COTTON	31872	48397	62834
TOBACCO	1414	2146	2787

SOURCE: World Bank Mission to Ghana; December 1989 "Ghana Medium Term Agricultural Development Programme", Table 4.12. Accra, Ghana December, 1989.

About 1% of this expansion in cropped area is expected to be induced as a result of growth in rural population, whilst the remaining 1.5% is to be met through programmes like the introduction of animal draught power, power

tillers and tractors, and exploitation of small-scale irrigation schemes. Utilization of fertilizers is also estimated to grow at 10% per annum, as a productivity enhancement strategy. To derive maximum benefit from this increased use of fertilizers, agricultural mechanization will have to be developed to ensure proper placement of fertilizers and ensure optimum utilization of these fertilizers by the crops.

Based on the above policy measures, it can be concluded that there is a very high possibility for increased use of agricultural mechanization inputs in Ghana in the 1990's. The actual supply of agricultural mechanization inputs to meet the anticipated demand will however be greatly influenced by such forces as the country's economic growth, population pressures, farming systems which will emerge, and finally but perhaps the most important, Government policies relating to mechanization.

CONCLUSION

In spite of the irrefutable evidence regarding the desire among farmers and mechanization professionals to mechanize, the mere will to mechanize is not sufficient - there must be a complete, widespread and profound understanding of the true dimensions of mechanized agriculture, including the benefits, pitfalls and other implications. As a nation and a continent, we cannot mechanize our agriculture unless there is a widespread desire to do so. This should include the individual farmers, community leaders, government officials and Governments themselves. Mechanization cannot be effectively promoted and sustained through sporadic effects or short-term programmes, what is needed is a long term programme backed by sound policies and strategies to catalyse its development.

Ghana presents an interesting case in the agricultural mechanization saga in Africa. At independence, the Government introduced agricultural mechanization in a revolutionary manner. Within a period of a few years the number of tractors in Ghana increased from a few hundred to several thousands. Tractors were imported or provided through aid programmes from all countries Russian, Yugoslavia, Czech, British, German, Canadian and American wheeled and crawler tractors were all imported. As Gordon (1970) noted ... "Perhaps nowhere else in the tropics can so many tractors be seen lying in yards or abandoned in the bush". It is also important to realize that lack of records hindered all attempts to assess the economics of mechanization in the Ghanaian agriculture in the period 1960-66.

From this exercise two things emerged, first the farmers appetite for mechanically powered mechanization was increased significantly and secondly the Governments which followed the Nkrumah's government were all too cautious with mechanization. The unfortunate thing about this whole exercise is that there followed a period when the whole programme was blamed on Marxism and socialist policies rather than being technically analysed without

any political biases (Gordon 1970). Draught animal power, which has been promoted through various aid programmes currently plays an insignificant role in Ghana's agricultural production system and is unlikely to become a major source of farm power given the other problems like tsetse flies, etc. It appears therefore, policy makers in Ghana have to find better and more efficient ways of introducing mechanical technologies in mechanizing Ghana's agriculture. To do this however we need to study thoroughly the past projects and determine the main reasons for their failure. It is only by learning from our past mistakes that we can succeed.

TABLE 12: PRODUCTION OF IMPORTANT CROPS: 1989-1989

	1982	1983	1984	1985	1986	1987	1988
1. CEREALS	544	308	1,066	909	867	905	995
Maize	346	172	696	584	559	553	600
Rice	36	40	65	68	70	81	95
Millet	76	40	133	112	110	271	300
Guinea Corn	86	56	172	145	128	..	-
2. STARCHY STAPLES	4,431	3,656	11,173	9,378	6,016	5,949	6,815
Cassava	2,470	1,728	6,186	5,193	2,876	2,943	3,300
Cocoyam	628	720	1,866	1,569	1,005	1,000	1,116
Yam	588	866	1,178	987	1,048	1,001	1,200
Plantain	745	342	1,943	1,629	1,087	1,005	1,200
3. PULSES & NUTS	1,342	1,331	1,214	1,013			
Groundnuts	111.1	91.1	167	140	190	..	..
Coconuts	337.0	338.8	265	219	..	..	..
Oil palm	889.4	889.4	768	643	..	..	..
Beans & Peas (dry)	14.1	11.7	14	11	20	..	..
4. VEGETABLES	186	202	674	566	670	..	..
Tomatoes		52.3	57.2	456	384	380	..
Pepper	62.6	62.6	74	62	137	..	..
Ocra	46.4	62.0	121	102	146	..	..
Garden Eggs	24.2	20.2	23	18	7	..	..
5. COCOA	202.5	168.1	166.7	194.4	226.4	233.6	288.8
6. OTHERS	178	224					
Sugar Cane	58.5	85.9	..	..	..	..	..
Orange	107.9	129.3	..	..	..	..	..
Pineapple	6.9	5.5	..	..	..	..	..
Banana	4.7	3.0	..	..	..	..	..

Source: Statistical Service Accra, Quarterly Digest of Statistics, Various Issues

As we noted earlier, research on agricultural mechanization problems of Ghanaian agriculture has been undertaken in an adhoc manner, with each small unit working in isolation. In many cases these small units have been starved of funds and other resources. Further they have concentrated on development of the hardware and little has been done researchwise, to develop better and more efficient management systems for agricultural machinery and equipment. The research effort has not been a waste, significant and notable achievements have been made in the post harvest field as was noted earlier. However we do not yet know why these post harvest technologies (cassava graters, palm oil processing devices) have been so readily adopted by farmers. Some of them are technically more complex than the mechanization technologies required for tillage. It is in the field operations that mechanization has yet to make a pronounced effect in Ghanaian agriculture. It is these field operations which make agriculture so unpopular among our young population and lead to rural urban migration. Perhaps our efforts in the last decade of the 20th century should aim at finding better and improved ways of introducing and managing the agricultural mechanization inputs required to reduce the drudgery of field operations. This is a challenge to all agricultural engineers as we approach the 21st century.

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