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THE EFFICIENCY ILLUSION OF GROSS MARGIN ANALYSIS: A CASE FOR VALUE ADDED COMPARISON*

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I- INTRODUCTION

One of the issues that should guide agricultural planners in the formulation of policies is efficiency measurement. Policies that centre on the efficient use of resources will aid the achievement of a rapid agricultural development. Planners usually adopt the price or allocative efficiency and technical efficiency as criteria for choosing between projects and policies. Price efficiency is based on a measure of marginal product and the opportunity cost. A resource is efficiently utilised if its marginal value product is equal to its marginal factor cost.

On the other hand, technical efficiency involves the measurement of the average level of output generated from a unit of a resource (input) or a bundle of resources employed in the production process. Hence, it is a product-factor ratio which is also commonly refered to as "average productivity". Examples of such measures are crop yields per hectare, number of eggs per chicken and milk yields per cow.

According to economic theory, allocative efficiency is maximised (under situations of resource rationing) when resources are allocated among production units (enterprises, industries or sectors of the economy) in such a way that the value of the marginal productivity of every resource in each production unit in which it is employed is equal. Economic efficiency implies technical efficiency and price efficiency. Technical efficiency alone though necessary, is not sufficient for economic efficiency because production on a technically efficient isoquant does not necessarily imply production with that optimal combination of resources which is determined by the input price ratio. Also, price efficiency, though essential, is not sufficient for economic efficiency since production may not be on the technically efficient isoquant. A manager that is economically efficient uses his resources at or very close to the economic optimum.

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Production functions, especially the Cobb-Douglas function, have commonly been used to determine the level of price efficiency of resources, based on cross sectional data. Also, linear programming method can be used to assess the level of efficiency of a number of firms utilising relatively homogenous resources. However, on a comparative partial basis, gross margin analysis and value added comparisons are quite common. A farm's technical efficiency values like gross output per hectare or per man-day or the allocative efficiency ratios in form of value added to scarce resources or gross margin per hectare or per man-day can be compared with the values for other types of farm organisation.

The gross margin of an enterprise is the difference between the total value of production and the variable costs of production. The gross margin of an enterprise, e.g. rice production, measures the contribution of that enterprise to the farms total profit. Given the fixed costs on a farm, an increase in the total gross margin from all the enterprises on the farm leads to a higher level of farm profit. When all the gross margins for each enterprise has been derived, a farm profit is obtained by deducting the common costs or fixed costs from this value. On the other hand, Ritson (1977), defines value added as the total value of farm sales at factor prices per time period less the value of inputs purchased from other firms. It is the return to all factors of production either owned or hired.

II- THE PROBLEM

All countries and particularly the third World Nations are faced with the basic economic problem of allocating limited resourdes such as land, capital and management to many different uses within and between the sectors of the economy. Because resources, are limited, diversion of a level of resources to a particular sector or a sub-sector leads to a reduction of an amount of resources to another. Thus a choice has to be made among competing uses of resources based on the relative contribution of a sub-sector or an organisation to the achievement of a country's fundamental objectives.

Efficient allocation of resources means that each sector is making the maximum possible contribution to meeting the objectives of the country. The agricultural sector of many developing nations has shown a degree of ineffectiveness in meeting the demands of these countries as reflected in high food imports, the increasing incidence of kwashiokhor and malnutrition and relatively low rural income. In Nigeria, for example, net imports of food and animals increased from N60.43 million in 1975 to N470.74 million in 1979, and the per caput food production index using 1969-71 as a base period, was only 88 in 1980 (Okuneye, 1982). To increase agricultural production a collective farming strategy has been adopted in several States of the country including Ogun State. Production cooperative societies and group farms have been established in this State so as to enhance food production and improve rural income, among other objectives.

Collective farming can be defined as a form of organisation in which an area of land is held and farmed under a unified system ofmanagement. The land may belong to members in which case farmers pool all or parts of their land together, or

it may belong to the State. This type of organisation is usually capital intensive. It is established as a result of the inability of a traditional farming system[1] to satisfy the needs and aspirations of the rural majority.

Arguably, faster agricultural growth requires either higher government investment in agriculture or re-allocation of resources towards the profitable subsectors of agriculture, or both, or an increase in government investment in agricultural research and suitable incentives to encourage farmers to increase their inputs of capital and labour. But if investment is to be increased, it must be well directed, and this in turn, necessitates objectives appraisal and evaluation.

The aim of this paper is to critically examine the level of resource use efficiency of individual and collective farms in Ogun State. While gross margin analysis has often been a main tool of analysis used to demonstrate the profitability of collective farms over individual farms, this paper attempts to point out the shortcomings of this tool and explains a method of deriving the value added to limiting resources by the two types of farm.

III- SOURCE OF DATA AND AREA OF STUDY

The primary data for this study was obtained from a randomly selected number of individual farmers and collective farms in Ogun State between March and September, 1980. In all, 125 individual farmers (members and non-members of collective farms) were interviewed through a questionnaire technique. Similarly questionnaires were administered to the Secretaries and Chairman of four randomly selected rice collective farms[2] in the State. In both cases, data were obtained through a repeated visit method. In general, this method is better than a single visit method, because the problem of inaccuracy due to errors of recall is drastically reduced. A higher degree of reliability can therefore be attributed to the survey data[3]. The area of study is shown in figure 1.

There is not much climatic variation between the different parts of Ogun State. The climate is marked by distinct dry and wet seasons. During the five month dry season (November - March) plants lose water and the soil moisture is reduced. The rainy season lasts for about seven months starting from the middle of March and ending in October. Generally, the main characteristic feature is a high but uniform temperature. Mean temperatures range from between 23°C on the coast to about 30°C in the north of Egbado. At the end of the dry season, humidity may be as low as 15 % but may well rise to 93 % during the wet season.

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1 Land and labour are the principal inputs of production of a traditional farming system. A very large proportion of the labour force is often provided by the family. It is often characterised by small and sacattered farm holdings which are partly determined by the land tenure system of the area.

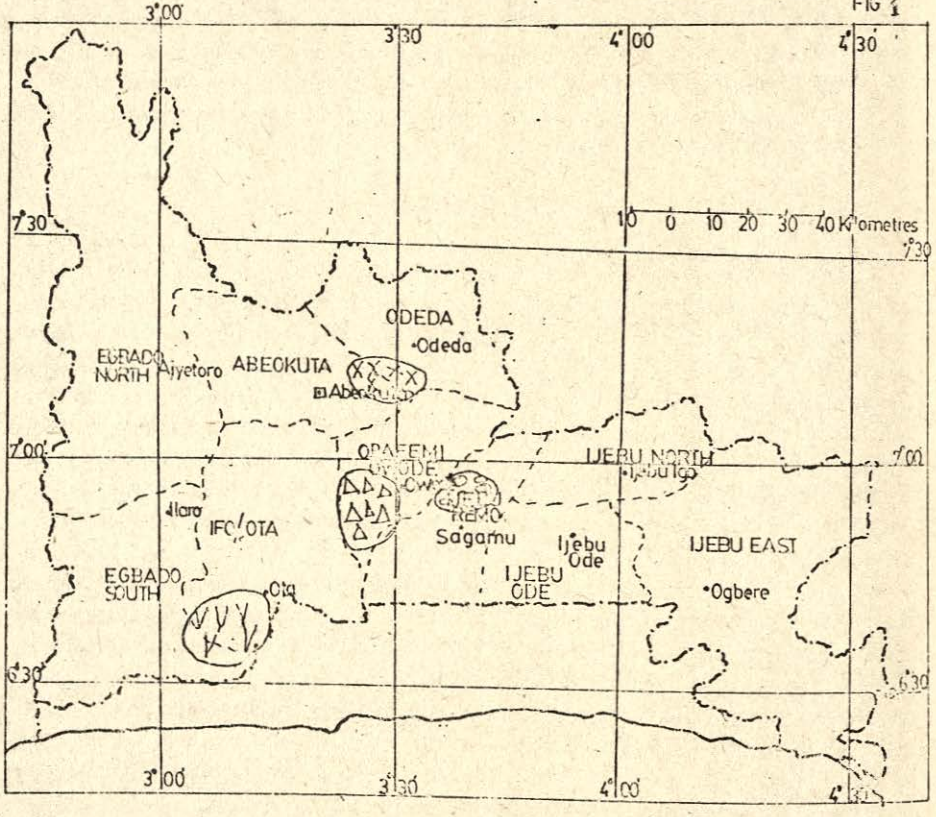
2 All these farms were registered as Rice collective farms, other crops were also produced but to a smaller scale than that of rice. There were also Cassava and Maize collective farms in the State.

3 For a full detail of the research methodology see, Okuneye (1982).

As a result of the distinct dry and wet seasons, Ogun State has a high but unevenly distributed rainfall. The mean annual rainfall figures for over thirty years are 120.5 cm and 161.5 cm for Abeokuta and Ijebu-Ode, the respective provincial headquarters of Abeokuta and Ijebu provinces. The natural vegetation in most parts of the State is characterised by rainforest with some patches of mangrove swamp forest in the south-east corner of Ijebu division but a large part of Egbado division has derived savanna vegetation.

OGUN STATE: SHOWING THE STUDY AREA

FIG 1



IV- RESULTS OF THE GROSS MARGIN ANALYSIS

The yield levels for the 1980 season are examined on the basis of the cropping pattern and the production system. The relevant data for the levels of yield and the gross margin per hectare for each crop are presented in appendices 1 and 2 for the individual and collective farms respectively. Recurrent land refers to that land in its first year of cultivation after bush fallow while the current land is the land which was cultivated, at least, in the previous year.

The comparative gross margins presented in Table 1 are derived by the use of weighted averages[4] for each crop, and in addition, in the case of collective farms for each association. It is revealed in this table that the collective farms are more efficient users of land than the individual farm. Similarly, the gross margin per man-day is far higher on the collective farms than on the individual farms. The receipt of collective farm prices[5] has resulted in higher values than those obtained with individual farm gate prices. Partly because these prices do not reflect the true scarcity of the products in this area, and there is the need to take care of all costa, value added comparisons are necessary.

Table: 1
Comparative Gross Margin Analysis for Both the Individual and Collective Farms at Collective Farm Prices (N)

	Individual Farm		Collective Farm
Gross Output per hectare	(525)	610	1.125
Gross Margin per Farm	(2300)	2,719	19,645
Gross Margin per hectare (ha)	(462)	566	1,034
Gross Margin per Man-day	(2.78)	3.06	15,64
Gross Margin per ha.of rice	(413)	508	1,138
Gross Margin per ha.of Maize/ Yam	(1183)	1,468	1,845

V- THE NEED FOR VALUE ADDED COMPARISON

Section IV has shown that gross margin per hectare and per man-day are higher on the collective farms than on the individual farms. However, these estimates disregard the cost to the economy of the supervision received by the collective farms from the extension men and the heavy input subsidies being enjoyed by the collective farms relative to the individual farms.

The value-added generated by an enterprise is the sales value of its products less the value of bought in goods and services. Since the supervision of the extension men should lead to increased profit, their services are intermediate inputs used in the production process. Largely because of this and because the input subsidies represent a cost to the economy there is the need to distinguish between the private and social costs and benefits. Given these various costs as they affect the different categories of farm, their net contributions to the economy can be estimated.

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4 The weighted values are obtained with respect to the farm size devoted to different crops to neutralise the scale effect.

5 The collective farm outputs were bought by some government agencies at prices a little higher than the individual farm gate prices.

VI- DERIVATION OF VALUE ADDED

In this section, value added calculations are based on:

1. Value added per farm man-unit (i. e. farm worker in man equivalents) of which the collective farm had 42.8 on average, all men, for the individual farm the labour force averaged 3.7 man-units in each household.
2. Value added per work hour.
3. Value added per hectare.

These values are derived on two assumptions. The first calculation adds to the costs the levels of subsidy for tractors hired, and inputs purchased by the two categories of farm as stated by the Ogun State Ministry of Agriculture and Natural Resources (M.A.N.R.). The second calculation is based on the subsidy levels for the country as a whole. This calculation gives the value added to the state resources and to those of the nation. Farm sales are calculated at the individual farm gate prices which are the market prices. It is appreciated that these market values may not represent the social values at opportunity costs, because among others these may be affected by import restrictions and other government policies which will distort the prices. In the absence of the shadow prices, market prices are used[6].

Input Subsidies

The levels of input subsidy as stated by the *State M.A.N.R.* are as follows:

a) 75 % subsidy on tractorisation involving ploughing, harrowing, ridging, planting and harvesting.
b) 50 % subsidy on seeds.
c) 75 % subsidy on fertilizers.

The various amounts paid by the farmers are presented in appendix three.

In the particular case of tractorisation, the *National estimate* is obtained from Dickie (1981). This states that, in general, the subsidy as a percentage of actual cost, to the users of tractors are about 89 % and 93 % for ploughing and ridging respectively in Nigeria. In the absence of data for harrowing, planting and harvesting it is assumed that the level of subsidy for tractorisation in general is 91 % - representing the average for ploughing and ridging. Also quoted by Dickie from Johnson (1968) is the level of subsidy on fertilizers in Nigeria. It is stated that a 67 % subsidy is given by the government on superphosphate and 60 % on sulphate of ammonia. However, these levels of subsidy increased to 83.3 % for urea and 77.5 % for sulphate of ammonia in 1977/78 (FAO, 1979). Only urea was applied on both the collective and individual farms in 1980. The level of subsidy for the 1977/78 production season is assumed for this analysis. In the absence of a national estimate, the level of subsidy assumed for improved seeds is that applying to the state, i.e. 50 %.

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6 The shadow prices can be obtained through linear programming or cost-benefit analysis.

The use of an estimated level of subsidy, for this calculation however, assumes an accurate derivation of the ratio of the prices paid by farmers to the actual cost of the inputs. While this assumption may not hold in all cases, one is, however, left with no alternative because of the unavailability of other data. Given the high level of tractor and implement breakdowns, low level of tractor usage as stated by Kolawole (1968) in Western Nigeria which still continues in Ogun State today, delays in the delivery of and unavailability of spare parts and inaccurate government records, it is possible that, in the special case of tractors the level of subsidy may have been an underestimate. Nevertheless, this is not a subject of discussion of this paper. The results arrived at are therefore as accurate as the assumptions made by the government.

There was no subsidy given to these farms on the fixed items of production such as sprayers, sacks, sheds and cutlasses.

Overhead and Administrative Costs

In calculating the gross national product of a country, monetary values are put on the goods and services produced in a country in the course of a year. In the derivation of value added to resources by the two categories of farm it is therefore appropriate to consider the Ministry costs in the form of salaries and administrative costs. This is further justified by the absence of man-power data that can be specifically attributed to each type of farm. Such figures represent proxy variables for managerial and supervisory skill since agricultural advice is more readily available for the collective farms as compared with individual farmers.

Given the low production of livestock, fisheries and forestry in the State, it is assumed that about 80 % of the overhead cost of the Ministry goes to crop production. Of this estimated cost, it is further assumed that the tree crop sub-sector attracts 30 % (i.e. 24 % of the total cost) because of the relative importance of Cocoa, Kola, Rubber and Palm produce in the State.

Ot the remaining 56 % of the total cost, three assumptions are made regarding the respective percentages attributable to the individual and collective farms. It is assumed that either 25 %, 50 % or 75 % can be attributed to the collective farms while the remaining proportion 75 %, 50 % or 25 % goes to the individual farms. Given the relatively high level of contact the estension men have with the collective farms, the assumption that these account for only 25 % of costs, however, is undoubtedly an underestimation.

In 1978/79, the total salaries and allowances of the M.A.N.R. Ogun State officials were estimated to be N2,600,000 (M.A.N.R., 1980). Assuming that there was an increase of 10 % due to expansion, promotion of staff and associated and yearly salary increases by 1980/81, the sums of N1,201,200, N800,600 and N400, 400 would represent the 42 %, 28 % and 14 % of the total overhead costs for each category of farms on the alternative assumptions stated above. Also in 1978/79 the "annual operating cost" (administrative cost) was N2,091,110. A similar 10 % increase in this is assumed for 1980/81 because of increases in staff and to account for inflation. The estimated administrative cost for 1980/81 is N2,300,221. The shares of administrative cost for the collective farms and individual farmers at 14 %, 28 % and 42 % are N322,000, N644,000 and N966,000 respectively.

Table: 2
The Mean Values of Overhead and Administrative Costs Per Farm Under Various Assumptions

Assumption	Individual Farm	Collective Farm
1	N 2.77	N 16.670.77
2	N 5.54	N 11.113.85
3	N 8.31	N 5.556.92

Table: 3
Comparison of Value a Added by the Collective and Individual Farms (N)

	Individual Farm						Collective Farm					
	State			National			State			National		
	1	2	3	1	2	3	1	2	3	1	2	3
Value Added per Hectare	452	451	451	452	451	450	−228	65	357	−267	26	318
Value Added per Man-Unit	608	608	607	608	607	606	−101	29	158	−118	11	141
Value Added per Man-Hour	0.65	0.65	0.65	0.65	0.65	- 0.65	0.66	0.19	1.04	−0.77	0.88	0.93
Value Added per Ha. of Rice	396	396	395	395	395	394	−114	178	471	−157	135	428
Value Added per Ha. of Maize/Rice	1176	1175	1175	1176	1175	1175	285	577	870	251	543	836

Notes: (a) The state and National Columns contain relevant figures derived on the basis of assumptions made in the unsubsidised prices of fertilizer and tractor operations - see Appendix 4.

(b) 1, 2 and 3 reprement assumptions 1, 2 and 3 as shown in Table 2.

(c) Calculation of Value Added per ha. of rice and that of maize/yam is limited to rice and maize/yam that were produced on recurrent land - see Appendices 5 and 6.

As at 1979/80, there were 130 collective farms in the State. About 65.6 % of Ogun State Population was estimated to be rural in 1980 (Okuneye, 1982) and 75 % of this rural population, representing, 49.2 % of the projected total population, i.e. 1,224,995, was in agriculture. Based on the mean farm household size calculated as 4.7 it is assumed that the rural population consists of 260, 629 farm families. The total of the overhead and administrative costs for each of the individual farmers and the collective farms at the assumed percentages are presented in Table 2.

After valuing all the farm outputs at market prices, the variable costs, and overhead and administrative costs are deducted. Weighted averages in terms of farm sizes and areas cultivated to specific crops are used to arrive at the value added per unit of resources in Table 3.

The collective farms record a far lower value added for all the resources excepting in assumption three under the state basis when only 14 % of the Ministry cost goes to them. In fact, when the National figures are considered, it seems probable that the collective farms detract from rather that add to the nation's income.

Conclusion

Gross margin analysis is advantageous in comparing the levels of efficiency between enterprises within firms partly because of the ease of its computation. However, it is limited in its scope for measuring resource-use efficiency since not all factors of production are fully accounted for.

Policy makers in many developing countries may be misplacing emphasis if their decisions are not based largely on the results of social cost-benefit analysis because the more basic objective which ought to govern agricultural policy is the maximisation of the agricultural sector's contribution to the national product. Given the poor performance of Nigerian agriculture over the years, there is a need to critically examine how resources are allocated to various sub-sectors and the net contributions of these sub-sectors to the achievement of national fundamental goals.

To arrive at a meaningful agricultural policy, the value added during the production process to be bought-in goods and services by the factors of production (namely labour, land, management and capital) for each type of farm organisation, needs to be accurately computed. The value added comparison has revealed that the individual farms are more efficient users of resources than the collective farms. Excent another approach for implementing the collective farming strategy is properly worked out, the improvement of Nigerian agriculture may only be better facilitated if resources are judiciously channelled to the individual farmers. As at now, efforts should be devoted to the development of a means of transforming the individual farming system to a commercialised peasantry which can aid the achievement of the expected role of agriculture in the economy.

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Appendix 1: Individual Farm: Analysis of 1980 Yield Levels

Crops	Total Cultivated Area (ha)	% of Cultivated Area	Yield (Kgs) per hectare	Man-days per hectare	Unit Price of Output(N)	Gross Output per ha.	Variable cost per hectare (N)				Gross Output per Man-day	Gross Margin per ha.	Gross Margin-per Man-day (A) (1)
							Fertilizer	Seed	Chemical	Hired Labour			
Recurrent (Fallow) Land:													
Rice	92.5	14.9	1398	197	0.352	492	2.09	10.52	0.78	65.30	2.50	413.31	2.43
Maize/Yam	75.0	12.1	613(a) 5683	234	0.202 0.205	1289	0.08	13.3	—	92.50	5.51	1183.12	5.45
Rice/Maize	37.5	6.0	430(a) 874	204	0.202 0.352	395	2.05	14.27	0.43	68.68	1.94	310.45	1.71
Current Land:													
Yam	42.5	6.8	3752	188	0.205	769	—	4.78	—	78.60	4.09	685.62	4.07
Rice	80.0	12.9	940	173	0.352	330	3.20	14.65	0.42	38.04	1.91	273.64	1.80
Cocoyam/Vegetable	52.5	8.4	692 402(c)	133	0.164 0.150	174	—	2.90	—	34.40	1.31	136.70	1.29
Maize/melon	43.75	7.0	421(b) 355	145	0.202 0.250	173	—	9.45	—	38.32	1.19	125.23	1.13
Yam/melon	25.00	4.0	2657(b) 354	192	0.205 0.250	634	—	8.25	—	56.83	3.30	568.92	3.26
Cassava/Maize	77.50	12.5	7672(a) 341	174	0.063 0.202	552	0.90	8.79	0.50	34.60	3.17	507.21	3.11
Cassava/Melon	52.50	8.4	7740(b) 375	181	0.063 0.250	574	—	5.08	—	38.30	3.17	530.62	3.14
Others	43.75	7.0		109		124	—	7.40	0.30	28.75	1.14	87.55	1.07

(1) This excludes hired labour cost, (a) Figures refer to maize, (b) Figures refer to melon, (c) Figure is in bundle unit and refers to vegetable.
Source. Survey Data, March-September, 1980.

Appendix 2: Collective Farm: Analysis of 1980 Yield Levels

Farm	Crops	Cultivated Area (ha)	% of cultivated Area	Man-days per Hectare	Yield Price Output N	Unit Price of Output	Gross Output (N) per		Variable Cost (a) per hectare (N)					Chemical	Gross Margin per ha. (N)	Gross Margin per man-day
							Hectare	Man-day	Hired Labour	Interest	Tractor	Seed	Fertilizer			
	Rice	20	71.4	59	2914	0.420	1224	20.75	3	12	47.85	14.82	7.5	4.80	1134	19.22
Abeokuta society	Maize/ Yam	3	10.7	108	586 7334	0.250 0.250	1980	18.33	22	12	36.15	17.8	8.9	7.50	1878	17.39
	Maize	8	17.9	46	1907	0.250	477	10.37	8	12	36.15	8.2	8.97	3.40	400	8.70
Owoda society	Rice	20	74.1	58	2850	0.420	1197	21.88	15	6	47.85	17.79	6.60	5.25	1100	19.64
	Maize/ Yam	5	18.5	89	528 7163	0.250 0.250	1923	21.61	30	6	36.15	15.87	10.0	3.50	1825	20.51
	Maize	2	7.4	51	1862	0.250	466	9.14	18	6	36.15	4.6	10.0	2.97	388	7.61
Ifo-Ota Group Farm	Rice	4	57.1	93	3028	0.420	1272	13.68	5	17	39.78	12.70	7.50	2.80	1187	12.76
	Maize/ Melon	2	28.6	173	1452 541	0.250 0.250	498	2.88	20	17	—	9.70	5.00	2.20	444	2.57
	Maize	1	14.3	58	1794	0.250	449	7.74	5	17	28.08	7.0	6.40	3.40	372	6.41
Remo Group Farm	Rice	6	66.7	78	3265	0.420	1371	17.58	54	12	36.15	16.96	6.29	3.50	1242	15.92
	Maize	5	33.3	48	1689	0.250	422	8.79	15	12	36.15	6.00	9.24	2.37	341	7.10

Note: (a) This excludes costs of "Juju" on rice farm and local traps set on farms

(b) Hired labour cost is not taken into account since the number of man-days worked by hired labourers has been included in column 5.

Appendix: 3
Operational Charges of the Tractor Hiring Unit and the Unit Costs of Seeds and Fertilizers

Operations or Inputs	Unit	Charges as at 1980
Ploughing	Hectares	N 21.00
Harrowing	"	7.08
Ridging	"	8.07
Planting	"	8.07
Rice Seed (056)	23 kgs	6.00
Maize	23 kgs	4.00
Cowpeas	23 kgs	6.00
Fertilizer	50 kgs	2.20

Source. Field Surrey March-September, 1980.

Appendix: 4
The Unsubsidised Costs of Variable Inputs as Used on Collective and Individual Farms (N)

Input	Collective Farms		Individual Farms	
	National Estimates	State Estimates	National Estimates	State Estimates
Tractor	3821.39	3149.5	—	—
Fertilizer	638.63	575	21.39	19.26
Seeds	508	508	77.64	77.64
Pesticide	81.56	81.56	1.39	1.39
Hired labour	285	285	262.54	262.54
Interest on Loan	196.25	196.25	—	—
Total	5.530.83	4.795.31	362.96	360.83
Gross Margins at Factor Price	11.604.52	12.340.04	2.251.54	2.253.67

Appendix: 5
Average Ministry Cost per Hectare (N)

Assumptions	Individual Farm	Collective Farm
1	0.56	877.41
2	1.11	584.94
3	1.67	292.47

Appendix: 6

The Unsubsidised Costs of Variable Inputs per Hectare of Major Crop Under the State and National Estimates (N)

Input	Collective Farm				Individual Farm			
	Rice		Maize/Yam		Rice		Maize/Yam	
	State	National	State	National	State	National	State	National
Tractor	183.20	222.28	144.63	173.48	0.0	0.0	0.0	0.0
Fertilizer	27.98	31.08	35.38	39.30	8.36	9.29	0.32	0.35
Seed	32.22	32.22	20.88	20.88	21.03	21.03	19.31	19.31
Pesticide	4.66	4.66	5.13	5.13	0.78	0.78	0.0	0.0
Labour (Hired)	14.08	14.08	216.00	216.00	65.30	65.30	92.51	92.
Interest (on Loans)	10.0	10.0	8.25	8.25	0.0	0.0	0.0	0.0