FOOD FOR DEVELOPMENT (PL 480, Title III)

"Implications of the Drought Syndrome for Agricultural Planning in East Africa: The Case of Tanzania"

by

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I. Present Financial Crisis: Root Causes and the Drought Syndrome

There is no question that the Tanzanian economy is in a state of crisis. But assumptions which typically emerge to explain what has caused the crisis and, therefore, the resulting design of what corrective measures should be taken and what likely impact they may have, vary widely among expatriate and national analysts. There is no dearth of interpretation from both official and unofficial sources.

Most of the analyses begin with a description of declining trends of productive output and value added from the agricultural sector since 1970. However, depending upon how one disaggregates, the picture changes considerably. Total agricultural output, total agricultural exports, and total value added to agricultural products in 1979/80 are less than they were in 1970. A simple regression shows a declining slope. However, the degree of variance is immense, suggesting that a different pattern could be lying underneath the facade of the simple trend line. Knowing the area to be similar ecologically to Kenya, where I had worked and analyzed agricultural output for several years, I thought of looking at the frequency of drought, and how agricultural output responded after each occurrence. Since farmers only apply costly inputs when risks are low, it would stand to reason that as risks increase, output would decrease. Since the number of droughts, their severity and frequency, were increasing (five in total since 1965, or one every three years) it would be only normal for farmers to revert back to the age-old pattern of mixed crops, with a high prevalence of drought resistant crops (the unexportable, low-priced, "inferior" demand crops), just in order to survive. One could assume that after each drought, an even greater proportion of crop land would revert back to these crops,

and only after a few years of recovery would the high input, high valued crop be tried again. By redrawing the trend lines without connecting the points between good years and bad years, a series of upward "recovery" slopes emerges. This was found to hold true for all indicators. From this vantage point, the concept of the drought-prone agricultural syndrome emerged.

Within this light, a simple question was asked, "How must the government allocate its scarce foreign exchange in times of famine--for petrol and consumer goods, to retire its debt, or for commercial food imports?" The obvious answer is the latter, which further aggravates the economic dilemma. In order to avoid the recurrence of famine, a policy of safety-first in food production must be adopted. This policy was in fact adopted by the Government after the 74/75 drought, encouraged by a US/AID $15,000,000 project and followed by the World Bank's National Maize Project. In addition, the National Milling Corporation adopted the policy of purchasing cassava, sorghum, millet, and pigeon peas at fixed prices.

However, the picture is complicated by a host of other, non-drought related, internal and external shocks. Some of these were of a political nature, most of which had support from the international community at large, but they all served to exacerbate the balance of trade deficit, a deficit which was already increasing on account of the frequency of droughts.

The specific internal and external shocks in question have recently been analyzed by R. H. Green and are listed in our original report. Internally, Tanzania was caught in the middle of revolutionary activities on many of her borders, to which she responded by making substantial

investments in infrastructure, material, and manpower. The Tanzania-Zambia railway, highway, and pipeline, plus the expansion of the ports, were done to allow Zambia to import and export while its original link to the sea through Zimbabwe and Mozambique was closed off. The real benefits from these investment were not received in Tanzania. In 1973, villagization was introduced to improve farm production and to increase access to public services, such as schools and health centers. This disrupted attention to the cashew trees. After a Michigan State/USAID study showed the cooperatives to be inefficient as marketing agents, the commodity marketing boards were formed in 1973-74. The retaliation to the Ugandan invasion cost dearly in 1978 and is still continuing, with 10,000 Tanzanian soldiers in Uganda today.

At the same time, oil prices increased, first in 1972, then again steadily since 1976, rising from less than $2/barrel to over $37/barrel. Since the warehouses of the marketing board's storage facilities were not located in all the villages (as was the case with the cooperatives) food grains required more and more intervillage transportation, with its concurrent gasoline cost increases. Moreover, worldwide inflation took off shortly after the initial oil price hikes, to further errode the developing countries' capacity to avoid foreign exchange deficits. Moreover, there was a general decline in worldwide food availability. As production shortfalls occurred throughout the world, Japan and Russia decided to use grain imports for livestock feed. All of these shocks arose during the mid-to-late seventies, and Tanzania has been hard pressed to handle them efficiently since then. However, one must be cautious in recommending drastic policy changes if one is to avoid overreaction to short-term distortions and

guard against vascillating from one policy thrust to another, which could act to amplify the oscillating production patterns rather than to generate stability.

Given the enormity of the new world price structure, it may be that the elimination of the foreign exchange deficit is unattainable through domestic policy actions, even if radical structural changes are included. Balance of payment relief will probably be required from the international financial organizations or OPEC for quite some time. A cursory look at the volume of imports shows a gradual increase from 1969 to 1973 and then a general leveling off up to the present. However, the value of imports rose slowly up to 1973 and has since increased at an alarming rate. On the other hand, the volume of exports has shown a relatively similar trend up to 1980, but the value of exports has risen at relatively the same rate as the increase in volume, and has not at all kept pace with imports. The aggregate price of exports has remained relatively constant. If these trends continue, the situation will only worsen. Even dramatic increases in export volume will not erode the trade deficit in the near future, and such surges in export volume are unlikely.

II. Productivity Analysis

2.1 Disaggregation by Seasons

The following figure shows the variation in coffee production since 1966 on the upper line and

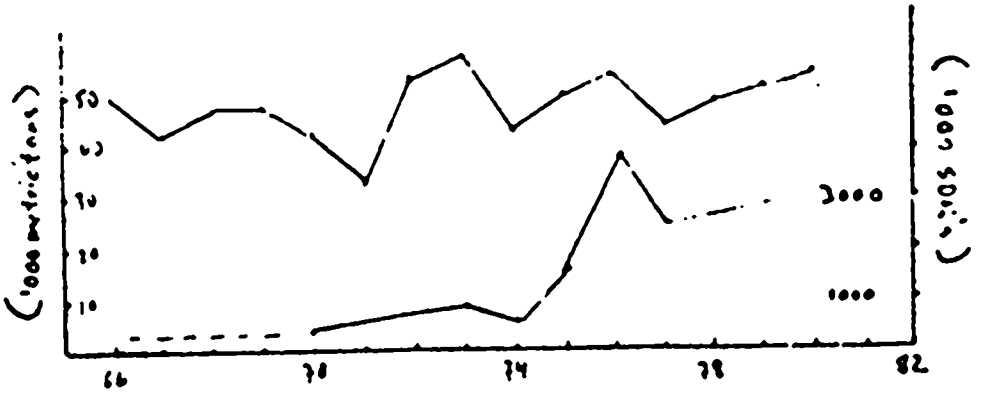

Figure 1. Coffee Production and Value

the lower line shows prices since 1973. With the occurrence of droughts in 1971, 1974, 1975, and 1979, it can be seen why production dropped off in those years. What cannot be explained is the drop in 1977/78. However, the tremendous price increase occurred in 1977/78, then dropped off sharply thereafter, and this dramatic shift may have led to some delinquency in collection. Also, with a flourishing black market trade to Kenya, it is certain that a significant share of the coffee crossed the border. Because of the undervalued currency in Tanzania, the price of coffee in Kenya was relatively much higher.

With respect to cotton, we have a somewhat different picture. The overall pattern

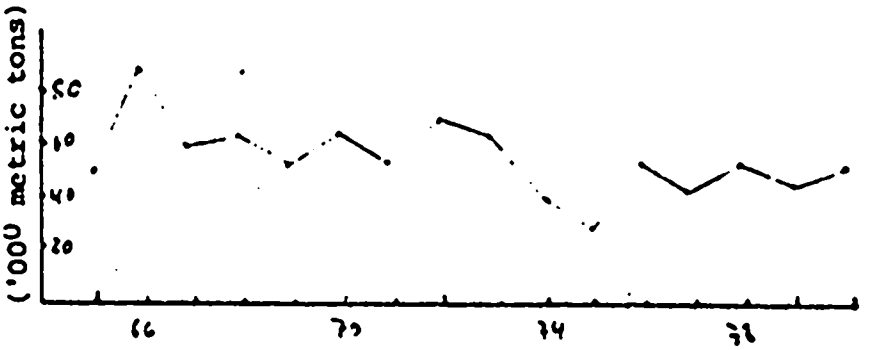

Figure 2. Cotton Production

is one of decreasing production, but if 1966 and 1974/75 are taken out of the figure, the trend line would look fairly constant. Once again, 1974 and 1975 were the drought years, as was 1971. With the heavy rains in 1977/78, damage occurred due to flooding, and hence those investors intent upon large incomes from cotton sales have been continually thwarted in realizing their goals. This should lead to less cotton acreage, given the fact that 1979 and 1980 appear to have been dry also.

Sisal production, or more properly stated, sisal marketings, have declined steadily and dramatically since 1965. Most analysts attribute

this decline to the fall in real prices in the international market, up until 1974. Although there was a jump in price at that time, they have fallen again since then. Production rehabilitation has been scheduled, with new plantings of 10,000 acres a year budgeted for the next few years. However, since 50% of production has traditionally come from hedgerows, an increase in producer price should give the small scale farmers increased incentives to harvest the hedgerows, an activity which has fallen off considerably in recent years due to the depressed prices and problems at the collection centers.

Production of cashews reached a relatively high point in the early 1970's but has declined rapidly since then. Since neither sisal nor cashews are particularly affected by the droughts, this decline must be explained with other reasons. Since the prices of cashews has risen significantly in the latter half of the decade, there is real concern over why production has fallen. The best explanation seems to be as a result of villagization which, in effect, took the people away from their trees. By relocating the farmers considerable distance from the cashew growing areas, the attention paid to cultivation, pruning, and harvesting has decreased. A second explanation is that the trees are old and their productivity has passed their prime. Without replanting, production increases are impossible.

Tobacco and tea have also avoided the ill effects of drought. Growing areas seem to be located in the high potential areas which are not drought prone, and hence suffer very little from lack of rains. These two crops have experienced a trend of increasing production since 1965.

Tobacco demand has been high due in part to the embargo placed on Zimbabwean tobacco. This competition will increase now, however, with the lifting of the embargo and Zimbabwe's reentry into the market with significant increases in plantings. Tea sales have been adversely affected by the lack of access to the Mombasa auctions. However, it seems that Tanzania has been able to surmount this constraint, at least for the time being.

Pyrethum is a relatively new crop but one which seems to be taking on a fair degree of importance. Production increased fairly rapidly up through the mid-70's but has since fallen off. Government officials have blamed competition from potato production (pyrethum is grown at relatively high altitudes where rainfall is adequate) in terms of labor and inputs but, while we were in Tanzania, claims of fraud and corruption led to a change of top management. It could be that in spite of good prices internationally, the producer's prices are remaining relatively constant and payments are being delayed.

Information on food crop production is virtually nonexistent. What serves as a proxy has been purchases by the agricultural corporation (up to 1973) and The National Milling Corporation. Although claims have been made that the government's creation of the NMC has constituted an inordinate concentration of production incentives towards food crops, especially the "inferior" demand crops such as sorghum, cassava, millet, and pigeon peas, this claim seems to have a shaky base when one analyzes food crop marketings prior to 1973. The list shows substantial marketings of these crops back into the 1960's by the NMC's predecessor organization. What is unique about NMC is not that they started buying these crops but that they introduced floor-pricing.

An analysis of overall maize production can be estimated by assuming total demand to be roughly 800,000 tons in 1970 and then subtracting imports to determine production levels. This leads to the following graph.

Figure 3. Maize Production and Demand

The major deficit period was 1973/74 and 1974/75, at which time NMC purchases were very low, and imports reached over 250 thousand metric tons each year. The function of the NMC is one of buyer-of-last-resort at a floor price substantially above the market clearing price. (See figure 4.)

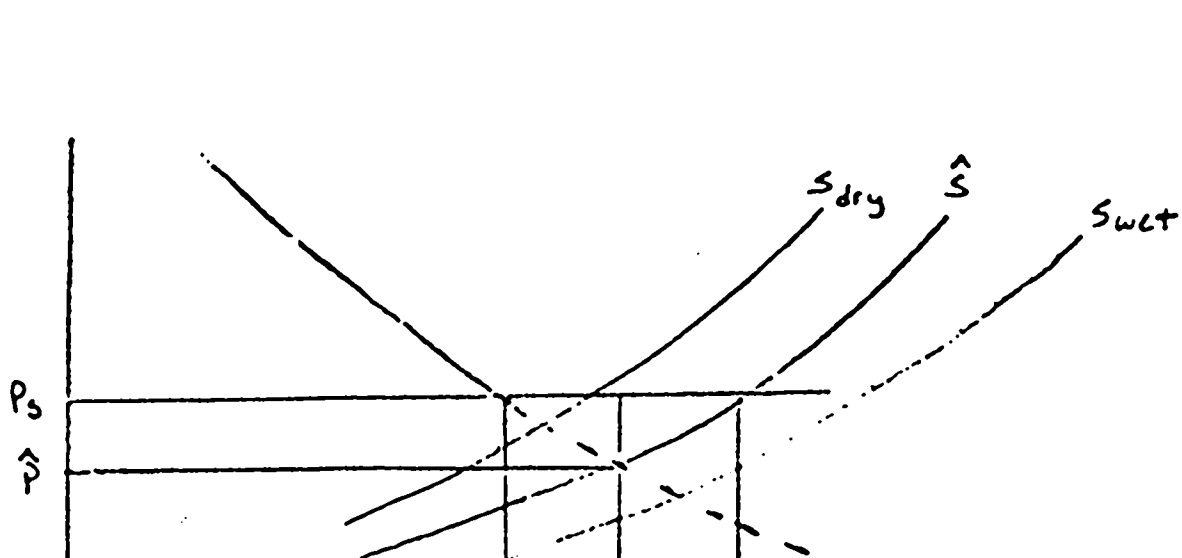

Figure 4. Shifts in Supply and the Effects of Support Prices

The figure above shows that the expected production level based on normal rainfall would be 900,000 tons ($\hat{Q}$). NMC purchases would then be $\hat{Q} - Q_c$, (Q_c= the sum of home consumption and unofficial sales), and the producer subsidy is the shaded area. However, $\hat{S}$ is rarely the actual supply curve, instead S_{dry} was during 73/74, 74/75 and S_{wet} was the situation for 77/78. NMC still made purchases for distribution to urban centers during S_{dry} but this was not sufficient for the demand and hence, imports were high. During S_{wet}, imports were nil and exports were made. However, the producer subsidy is greater in wet years than it is in dry years and, by definition, is always present when purchases are made. When present day handling and transportation costs are included, this cost is higher than export prices, and hence the operation is a money loser even in years when exports can be made. When storage costs and inventory finance charges are added in, the production subsidy becomes even greater. The real problem is not the cost of this policy, because it is an expressed government policy and strategy, but how this cost is financed. At present the government has decided to cover the costs of operation of the NMC by granting credit on an annual basis. However, since this is basically a producer and consumer subsidy program, targeted to the poor as a proxy for a wage subsidy, Government should charge these costs as development expenses. The taxation for this policy must be borne by the society as a whole, rather than claiming inefficient operating procedures on behalf of NMC management.

Although NMC operates in a similar way in terms of floor-pricing and buyer-of-last-resort for cassava, sorghum, millet, and pigeon peas, there is no consumer subsidy. Hence, the overall subsidy is theoretically less. But since the demand for these crops is much lower than for maize,

the total value of the subsidy is greater, and farmers market more through the NMC. During dry years this is acceptable because it insures adequate production to safeguard against famine, but in good years the excess supply comes in well above the world price. Then, as stocks are held as a strategic reserve, losses are experienced in terms of storage loss, inventory carrying costs, and price differentials (i.e., exporting at prices below purhcase price). The only cost-cutting that can be contemplated if this policy of famine avoidance is to be continued is to not hold the stocks, but to sell immediately. The losses incurred in this system, once again, should be accounted for as development expenses, a taxation on society-at-large, rather than as an operating loss to the NMC. Without establishing this shift in the accounting principles of the NMC, Government will be in the eternal position of condemning NMC management for operating inefficiencies far beyond their control.

2.2 Disaggregation by Crop

Further disaggregation is required than simply noting the two main groups of crops, food crops and export crops. Some cash crops can be processed and sold domestically and some food crops can be exported. These latter types of crops have been labeled the swing-food crops (maize, rice, and wheat). The "inferior demand" crops become the drought-resistant crops (cassava, sorghum, millets, and pigeon peas). An extremely important category of crops emerges as the oil seeds. These crops are relatively drought-resistant, have strong international and domestic demand, have under-utilized value-added processing capacity in place within Tanzania, and require low levels of purchased inputs even for relatively high production levels (castor, sesame, groundnuts, and sunflower). Actually, the cash crops should also be disaggregated into tree crops and annuals, the difference relating to the time lag which results between the farmer's decision to expand acreage planted, and the first year's production. For tree and bush crops such as sisal, cashews, coffee, and tea, this time lag is 4 to 7 years, with maximum output levels being achieved after 10 to 15 years in some cases. However, the annuals--cotton, pyrethrum, and tobacco--experience shifting acreage due to competition from food or other oilseed crops on a seasonal basis. Hence, policy issues for these crops are substantially different compared to the former crops, the tree or bush crops. Lastly, some comment should be made about the basic risks involved in the production of each crop. This will follow the presentation of the basic input-output relationships for the crop groupings.

2.21 Existing Cropping Patterns

As the frequency of drought increases, small-holder farmers are forced into a safety-first cropping pattern response. When this happens, production of risky food or export crops declines, and the acreage of more

drought-resistant crops increases. However, the extent to which one crop group replaces acreage of another depends upon the ecological environment and the speed with which farmers can substitute plants. Obviously, a sisal plantation cannot be seeded in maize, nor can substitutions be made in coffee, tea, or cashews. However, such substitutions are agronomically feasible in tobacco, pyrethum, and cotton. The extent to which this substitution takes place has not been documented, however, and there is some speculation that production shifts of competitive crops is not the result of relative price changes but rather due to absolute price decreases, the effects of drought or flood, or problems of marketing or processing.

The major crop categories are grains, pulses, and cash crops. The small-scale farmer generally raises these crops in combination, within the same field or in neighboring plots. In this way, the small-holder diversifies against risk. As the risk of drought and pests increases, these combinations are heavily weighted towards drought-resistant crops. As rainfall improves, more preferred food grains are seeded. Like a field of maturing wheat waving in the wind, the cropping patterns shift back and forth from dry to wet crops and rotating among fields, crop to fallow to pasture. This shifting cultivation pattern defies planned production. Price incentives only partially work. Marketing institutions fail to manage the market efficiently under these conditions. Within this context, Government must come up with policy incentives which support the recognition that farmers will protect against famine first (the safety-first, risk aversion principle) while at the same time, they desire some monetary income from cash crops. The following analysis compares several incentive schemes, from straight price support and input subsidies to crop-insurance schemes, all within the present subsistence production system and the new technologies already developed but infrequently put into practice.

2.22 Traditional Input Requirements and Production Returns

Under conditions of subsistence agriculture in food crops and small-holder production of export crops, material inputs purchased are relatively low. Some variation exists among crop groups but it is obvious that food, drought, and oil crops require minimal levels of inputs, whereas even at low level small-holder production levels, the amounts of purchased inputs for the cash crops are substantial. In terms of labor input, the requirements across crops is more even except, once again, for cash crops, which use twice the amount of labor demanded for food crops. Return rates are hard to define in subsistence agriculture because of the low level of purchased inputs and the difficulty of finding opportunity costs for family-owned resources. However, returns to a day of labor can be estimated, and the table shows cash crops earning 67% more than the other crop groups, which are all equal at 6/= per day. Current wage rates in agriculture vary between 10/= and 15/= depending upon the area, crop, and technical level of employment. The last row in the table shows the degree of present government subsidy for each crop group. For food crops the subsidy is on maize only, not rice and wheat. Although because of the crop grouping, the cash crops show no subsidy, some cash crops require government assistance to cover excess marketing and processing costs. The data for the analysis shown in Table 1 were derived from publications by the Marketing Development Bureau, and are presented in Table 2 on a crop-by-crop basis.

The question of risk enters into small-holders' decision matrix. Most risk measurements are directly correlated to the value of purchased inputs, and may include the imputed value of owned resources as well. The higher this total value accrues, the greater is the small-holder's perceived risk. Straightforward deduction, then, shows that the

TABLE 1

Costs and Returns under Existing Technology Levels
(TShs./ha)*

	Food Crops Maize Rice Wheat	Drought Crops Sorghum Casava Pigeon Peas	Edible Oil Crops Groundnuts Sesame Sunflower	Export Crops Cotton, Cashew Coffee, Tobacco Tea, Sisal Pyrethrum
Purchased Inputs[a/]	40	7	84	600
Labor (workdays)	100	123	126	196
Gross margin[b/]	642	748	800	2000
Labor returns[c/]	6/=	6/=	6/=	10/=
Present Government Subsidy	80¢/kg.	40¢/kg.	(+100¢/kg)[d/]	(+239¢/kg)

*Source: Derived from MDB price policy reports. Averages weight each crop equally, not by volume of production.

[a/] Seeds, machinery, fertilizer, dust and sprays, and other material inputs.

[b/] Value product less purchased inputs.

[c/] Gross margin divided by labor workdays.

[d/] No subsidy.

cash crops are significantly more risky than food or drought crops. And as the perception of the expected loss increases due to more frequent crop failures, the relative weight of the risk also increases. Although the risk of crop failure is relatively low for the tree crops, their expected loss function is quite high due to the high cost of the inputs. More significantly, the risk for the annuals such as cotton, tobacco, and pyrethrum is the highest because the probability of crop failure is high and the costs are higher than

TABLE 2

Crop Input-Output Relationships

	Maize[a/]		Rice[b/]		Wheat		Cassuva		Sorghum		Pigeon Peas		Ground-nuts		Sesame		Sun-Flower	
	T	I	T	I	T	I	T	I	T	I								
Yield (Kgs)	640	2700	400	3600	430	700	1400	5000	600	1200	300	670	300	700	250	600	400	60
Producer Price (Shs)	1.00		1.75		1.65		.65		1.00		3.00		4.00		3.50		1.45	1.
Value Product	640	2700	700	6300	710	1155	910	3250	600	1200	900	2010	1200	2800	875	2100	580	90
Inputs																		
Fertilizer		260		206										140		50		5
Pesticides		40								48				30				
Other[c/]	28	40	45	300	50	240	-	196	15	22	-	210	200	280	40	40	14	1
Total	28	340	45	506	50	240	-	196	15	70	-	200	200	450	40	90	14	6
Labor (workdays)	107	150	120	394	80	60	142	200	105	107	75	120	160	219	123	150	95	10
Gross Margin	612	2360	655	5794	660	915	910	3054	585	1130	900	1800	1000	2350	835	2010	566	8:

[a/] T = traditional subsistence smallholders.

I = improved technologies for smallholders.

[b/] For rice, T = non-irrigated, traditional and I = irrigated, improved.

[c/] Includes seeds and other purchased inputs except labor.

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TABLE 2a

Crop Input-Output Relationships

	Cotton		Tobacco[b]		Pyrethrum		Coffee Arabica		Coffee Robusta		Tea	Sisal		Cashews	
	T	I[c]	T	I	T	I	T	I	T	I	Year 7 (I)	T	I	T	I
Yield (Kgs)	350	700	477	750	225	500	350	1200	225	1000	650	600	1430	350	1600
Producer Price (Shs)	3.03		12.00		7.50	9.50	10.00		8.40		7.2	2.28		1.74	
Value Product	1061	2121	5724	9000	1688	4750	3500	12000	1890	8400	4680	1368	3260	609	2784
Inputs															
Fertilizer		230	1200	1790		248		300		177	1248		100		
Pesticides	142	439	75	75		104	100	779		35				38	75
Other[a]		.	464	464	40	140	930	1140	460	460	40	100	200	15	233
Total	142	669	1739	2329	40	492	1030	2219	460	672	1288	100	300	53	308
Labor (workdays)	169	220	450	660	233	324	140	351	73	225	250	75	200	56	155
Gross Margin	919	1452	3985	6671	1648	4258	2470	9781	1430	7728	3392	1268	2960	556	2476

[a] Seeds and other material costs.

[b] Flu-cured although many of the calculations were made with fire-cured, whose gross margin is 1910/=.

[c] T = unimproved smallholder, I = improved smallholder.

for the food, drought, or oil crops. Hence, the likelihood of acreage substitution between these crops and their principal competitor, sorghum, maize, and potatoes respectively, is quite significant. Using crude estimates for the expected value of the loss function for maize, sorghum, cotton, the oil crops and the principal export crops, gives the following comparison shown in Table 3.

If risk is converted to a cost premium and added to production costs or processing costs, the three major export crops which compete with food crops lose their competitive advantage. It may be wiser, under such precarious conditions, to withdraw the support and promotion of these crops and pursue the swing-food crops instead. From an efficiency viewpoint such a policy may be more rational. The perception of risk so far has only considered production variation. However, for the three crops mentioned, substantial price and institutional risks also exist. Since the food crops have, in general, fixed floor prices, their demand is perfectly elastic at the expected level of output. However, for the export crops whose producer price is the world price less institutional costs in principle, price variations can be significant. This increases the risks as measured. Thirdly, institutional failures, i.e., the decision not to purchase or delaying producer payments, adds another element of risk to the export crops. And unlike the market for maize, there is not a substantial black market for cotton, tobacco, or pyrethrum except perhaps near Tanzania's borders. Lastly, the value-added transformation process carries its own risks. This is particularly important for fire-cured tobacco. There are indications that the curing process is not being carried out adequately, thereby reducing the amount of salable tobacco reaching the market and, hence, significantly increasing processing costs. As these risks increase and competition from Zimbabwe starts up again, the situation for tobacco will begin to deteriorate rapidly.

TABLE 3

Gross Margin Variation Estimates for Risk Calculation

Crops	Gross Margin ($\bar{w}$)	Purchased Inputs	Standard Deviation (σ)	Coefficient of Variation, ($\frac{\sigma}{\bar{w}}$)	Value Product	Expected Value of the Loss Function
Cotton, Tobacco, Pyrethrum	1492	470	1790	>1.0	1962	-225
Sisal, Cashews	912	56	365	< .5	968	-50
Coffee, Tea	2430	926	1215	.5	3356	-330
Food	642	40	449	.7	682	-17
Drought	748	7	299	.4	755	-0.5
Oil	800	84	720	.9	884	-43

a/ Value product less purchased inputs = $\bar{w}$

With this further disaggregation of the export crops, input levels and return rates have been recalculated. The following picture then emerges, as presented in Table 4.

TABLE 4

Disaggregating Export Crops

	Cotton, Tobacco, Pyrethrum a/	Sisal, Cashews	Coffee, Tea
Purchased Inputs	410 (695)	56 (106)	926 (1256)
Labor (workdays)	767	66	154
Gross Margin	1492 (1267)	912 (862)	2430 (2100)
Labor Returns	6/= (5/=)	14/= (13/=)	16/= (14/=)

( ) adding the expected value of the loss function as a risk premium cost.

a/ Fire cured tobacco.

Perhaps this shows why acreage in cotton, tobacco, and pyrethrum is falling off. Although the gross margin appears to give twice the return per hectare than food or drought crops, the returns to investment and labor, when charges for risks are included, are lower for these crops than they are for their competitor food crops. (The calculated risk premium for food, drought, and oil crops are 17/=, 1/= and 59/= respectively.)

In addition to shedding light on the competitive problems of the annuals, this disaggregation further explains what are presumably the situations for the other two groups. For coffee and tea, the high returns to labor and the large gross margin appear to explain why those crops are doing relatively well. However, the low investment returns to sisal and cashews do not wholly explain what is happening there, especially if it is recognized that the dip in marketings is due to a decline in harvestings of producing plants rather than a significant decline in production itself. This seems unexplainable given the estimated labor return rate. Since labor returns are more than twice what they are in the food crops, one would think that the small-holders would continue to care for their plants and harvest on schedule. Perhaps the uncertainty of the market, i.e., late payments and inaccessibility to assembly areas, is seriously affecting harvesting decisions.

The conclusions to be drawn from these more detailed disaggregations suggest that the annual export crops face serious competition from the swing-food crops, such as maize, sorghum, and the edible oils. Given the proportion of foreign exchange required to produce these exports compared to the food crops, perhaps the emphasis on the latter is economically and socially justifiable.

One calculation which is interesting to present given the current economic crisis is the local and foreign exchange costs to produce a shilling's worth of the respective crop. The domstic resource costs for export, food, and oil crops is about 5¢ per kilogram. However, the foreign exchange resource cost is 18¢/Kg for export crops, only 1¢ kg for food crops and 4¢/Kg. for oil crops. Once again, the bias for food crops emerges. With the existing scarcity of foreign exchange plus the imputed costs for licensing of imports and the risk premium for actually obtaining delivery of imported goods, the 18¢/kg. is significantly undervalued; 25¢ to 30¢ would be more accurate.

2.23 The Potential with New Technology

A fair amount of research has already been carried out within Tanzania, and has produced significant increases in production potential. However, at present, the small-holders have not been able to adopt these new technologies because of the constraints they face. Table 5 presents input requirements and returns with improved small-holders technologies for the major four crop groupings. The table shows that the highest returns per investment are obtained in the drought crops and oil crops, followed by food crops. Although the export crops earn the largest returns to the hectare, they cost the most to produce and, hence, their return rates to capital and labor are much lower than they are for the other crops.

TABLE 5

Cost and Returns with Improved Smallholders Technologies
(shs/ha)

	Food Crops	Drought Crops	Edible Oil Crops	Export Crops
Purchased Inputs	362 (300)[a]	133	201	1035
Labor (w.d.)	200 (120)	154	159	300
Gross Margin[c]	3023 (2000)	1995	1732	3534 (4839)[b]
Labor returns	15.12 (16.67)	12.96	10.89	11-78 (16.13)
Returns to Purchased Inputs	8.35 (6.67)	15.00	8.62	3.41 (4.68)

[a] ( ) w/o irrigated rice
[b] ( ) includes coffee
[c] value product less purchased inputs.
[d] gross margir divided by total labor.

SOURCE: Calculated from MDB reports

Once again, subdividing the export crops changes the situation substantially. The breakdown shows how cotton, tobacco, and pyrethrum earn the lowest returns, actually less than the drought and oil crops in terms of labor and less than all the other three in terms of capital. Sisal and cashew earn the equivalent of food crops. Only coffee and tea show that economically they are the superior crops.

TABLE 6

Returns to Export Crops

	Cotton, Tobacco, and Pyrethrum	Sisal, Cashews	Tea, Coffee
Purchased Inputs	788 (1175)	304 (412)	1393 (1967)
Labor (w.d.)	381	178	385
Gross Margin	4127 (3740)	2718 (2610)	6967 (6393)
Labor Returns	10.83 (9.82)	15.27 (14.67)	24.45 (22.43)
Returns to Purchased Inputs	5.24 (3.18)	8.94 (6.33)	5.00 (3.54)

When the risk premium is added to the new technologies, the shift in relative efficiency rates is even more dramatic, especially in returns to purchased inputs.

TABLE 7

Risk Calculations with Improved Technologies

Crops	Gross Margin ($\bar{x}$)	Purchased Inputs	Standard Deviation, $6\sigma\bar{x}$	Coefficient of Variation ($\frac{6\sigma}{\bar{x}}$)	Value Product	Expected Value of the Loss Function	Returns[a] to Labor	Returns[a] to Inputs
Cotton, Tobacco, Pyrethrum	4127	788	4952	71.0	4915	-387	9.82	
Sisal, Cashews	2718	304	1087	<.5	3805	-108	14.67	
Coffee, Tea	6967	1393	3484	.5	8360	-574	22.43	
Export hops (w/o coffee)	3534	1035	2827	.8	4569	-470		
Food Crops (w/o rice)	2000	300	1000	.5	2300	-124		4.42
Food Crops (with rice)	3023	362	1209	.4	3385	-201		5.02
Drought Crops	1995	133	399	.2	2128	-43		11.09
Edible Oil Crops	1765	168	1236	.7	1933	-86		6.61

[a] When the risk value is added to purchased inputs.

TABLE 8

Comparison of Return Rates

Crop Group	Food	Drought	Oil	Cotton, Tobacco Pyrethrum	Sisal/ Cashew	Coffee/ Tea
	Existing Traditional Technology					
Gross Margin	642 (625)	748 (747)	800 (741)	1492 (1267)	912 (862)	2430 (2100)
Labor Returns	6.42 (6.25)	6.08 (6.07)	6.35 (5.88)	5.59 (4.75)	13.82 (13.06)	15.78 (13.64)
Returns to[a/] Purchased Inputs	16.05 (15.63)	-	9.52 (8.82)	3.17 (1.82)	16.29 (8.13)	2.62 (1.67)
	Improved Technology					
Gross Margin	2000 (1876)	1995 (1952)	1765 (1679)	4127 (3740)	2718 (2610)	6967 (6393)
Labor Returns	16.67 (15.63)	12.96 (12.68)	11.10 (10.56)	10.83 (9.82)	15.27 (14.67)	24.45 (22.43)
Returns to Purchased Inputs	6.67 (5.02)	15.00 (4.42)	10.51 (6.61)	5.24 (3.18)	8.94 (6.33)	5.00 (3.54)

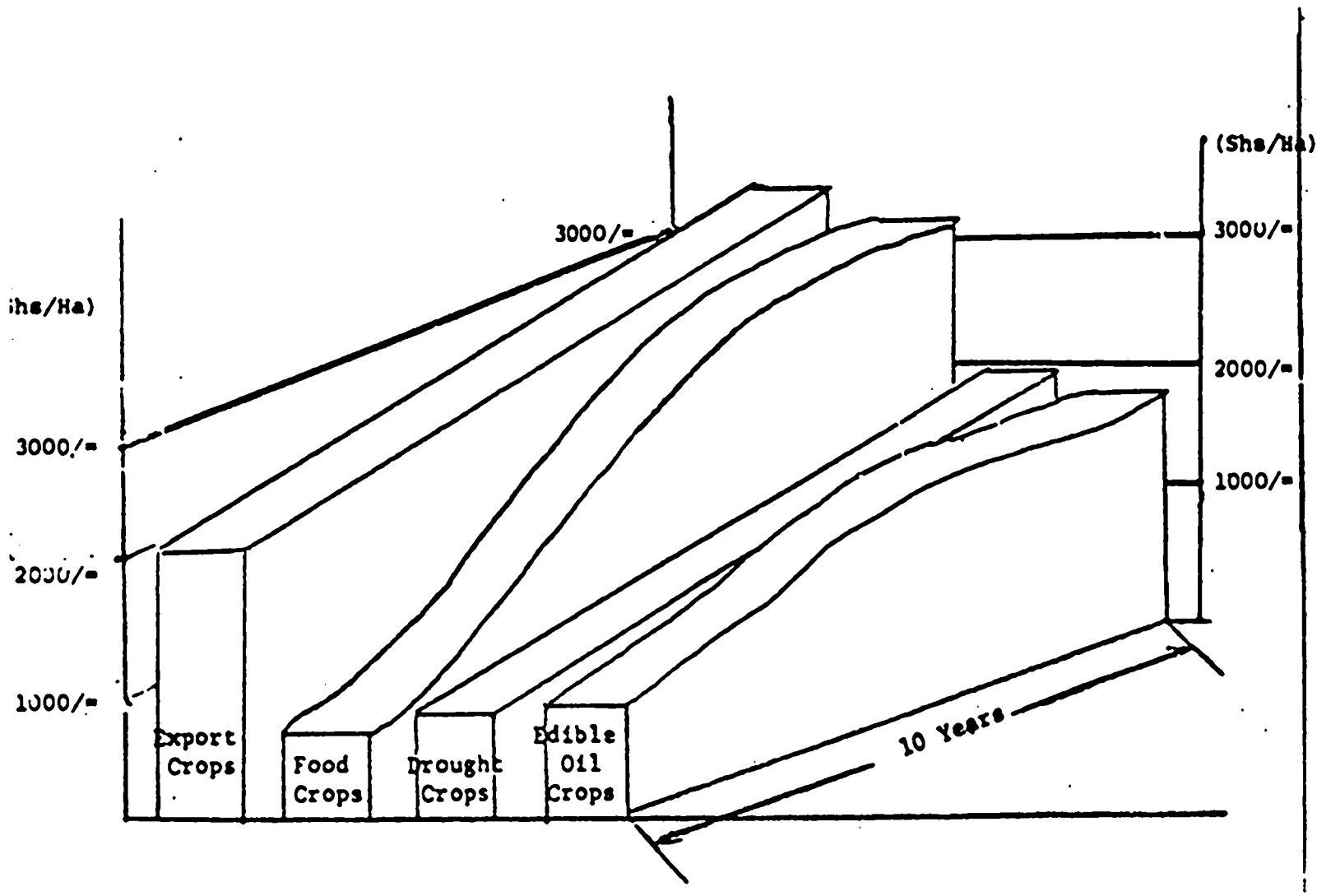
[a/] This returns to purchased inputs does not include land costs nor hired labor costs. Presumably, both of these costs would be higher for the export crops than for the food, drought, and oil crops

The analysis shows that returns to labor increase significantly for all crops, but returns to cash decline for the food, oil, and sisal/cashew crops. Since cotton, tobacco, and pyrethrum and coffee and tea already use a fair amount of cash inputs under the existing technologies, their return rates with new technology do indeed increase, even when the risk premium is included. However, it should be recognized that returns to cash are meaningless when the level of cash inputs is very low, as it is for food, drought,

and sisal/cashew crops. Nevertheless, the figures show that for smallholders with basically a shortage of cash, the food and oil crops return more per shilling invested than do the annual export crops, their basic competitors. These findings should be kept in mind when the cropping systems program begins to develop mixed cropping packages.

Without further incentives than those presented above, farmers will slowly move towards the higher input levels. However, this will occur very slowly, and will generally follow the S-shaped adoption rate curved, described mathematically as the logistic growth or learning curve. Given the calculated return rates, a rough estimate has been drawn showing the estimated responses by crop group over the next ten years. The following figure shows roughly a linear response for export crops, which could be disaggregated to the annuals, sisal and cashews, and coffee and tea. Presumably, the response curve for the latter would be faster than the former and for sisal and cashews an estimate would be difficult to make. Food crops, principally maize, should follow the S-shaped path. Drought crops are the security crops, and will improve slowly over time, whereas the oil crops will presumably turn into surplus crops for processing and export, and hence exhibit rather rapid adoption rates. One thing in favor of oil crops is the relatively competitive nature of the demand for such crops, and the lack of concentration in processing. The oil seed parastatal handles imports, distribution, and exports but does not control processing or domestic sales. As a result, there is no subsidy on processing nor is there solid information on costs per kilogram purchased. Excess capacity of plant and equipment does exist, however, so presumably high per unit processing costs are present.

Figure 5 New Technology Adoption with Research/Extension Support
(Gross Margin/Ha.)



2.24 Marketing and Processing Costs

In the mid-seventies, the cooperative unions and/or marketing boards were replaced and marketing and processing parastatal organizations were formed. Most of these organizations provide subsidized inputs to participating farmers, offer extension services, schedule production acreage somewhat, and purchase, transport, store, process, and export the crop. Parastatals exist for all of the export crops considered in this analysis, as well as for sugar, which has not been included because of its minimal interface with small holders.

As noted in the team report: " . . . the parastatals have not been successful in reducing marketing costs; rather marketing costs have been increasing at an increasing rate. The export crop parastatals have a complete monopoly (other than leakages) of all activities associated with the supply of inputs and procurement of outputs for the crops they control and they have a great deal of latitude in exercising this authority. 'These functions include procurement, transport, storage, processing (where applicable), and export sale within the sphere of production development.'[1/] As a general rule prices received by producers are export prices net of marketing margins including export and production taxes. Upward pressures on parastatal costs appear to come from two sources. The parastatals are monopolies (and monopsonies) and they exhibit the declining unit cost curves normally expected in monopolies. Because four of the crops marketed by the parastatals have been declining in output at least over the past half dozen years, the parastatals have

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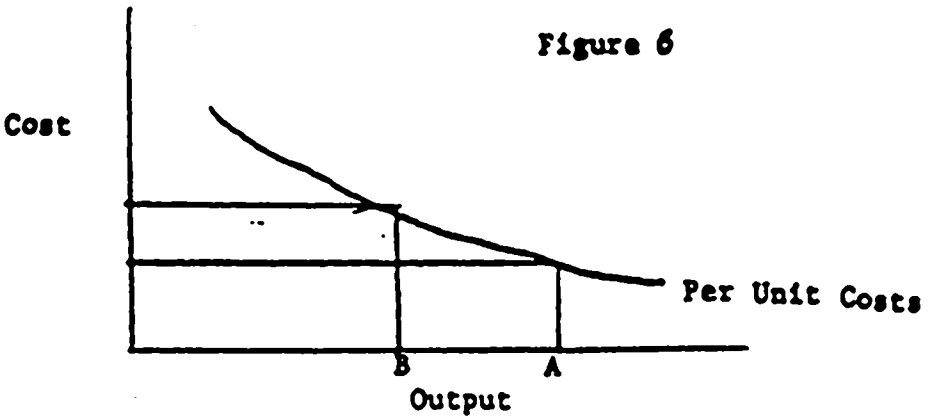
[1/] Ellis Ag Pricing Policy

been moving up the cost curve from point A to point B in the illustration (Figure 6) with consequent rising per unit marketing costs. In addition, the costs curves for the parastatals have been shifting upwards as costs of various items have risen over time. Costs have been increasing because of inflation, increasing administrative costs, particularly for personnel, and because of less than desirable efficienty of operations. It appears that the more important of the first two factors is increased per unit costs due to production short-falls. For example, data published by the Ministry of Agriculture[2/] show a slight decline in per unit costs as production of cotton increases from 280,000 to 350,000 bales despite a 22% increase in total costs. An analysis of the Cashewnut Authority of Tanzania operations by Ellis shows a similar trend.[3/] Marketing margins were 36% for production of 143,000 tons, 49% for production of 82,000 tons, and 60% for production of 60,000 tons of cashewnuts."

Figure 6



2/ Price Policy Recommendations for the 1981-82 Agricultural Price Review, Annex 8 Cotton, Ministry of Agriculture, Sept. 1980.

3/ Ellis, Frank, Marketing Costs and the Processing of Cashewnuts in Tanzania: An Analysis of the Marketing Margin and the Potential Level of Producer Prices Mimeo, Feb. 1980.

Information drawn from Marketing Development Bureau reports gives some indication of the per kilogram costs of marketing and processing, including taxes and personnel costs. It is interesting to note that per kilogram costs are roughly equivalent for maize, cassava, sorghum, and sisal, whereas those crops which have value added through processing have widely varying unit costs. Under the price structure of 1980, maize, cassava, sorghum, cotton, tobacco, tea, and pyrethrum were subsidized, in the sense that the sum of producer prices plus marketing/processing costs were greater than the retail or export price. The degree of producer subsidy was roughly 50¢ for maize, 20¢ for cassava and sorghum, 1/50 for cotton and pyrethrum and 4/= and 5/= for tobacco and tea (per kilogram) respectively. With the rise in the costs of administration, personnel, inventory (storage) and plant and equipment finance charges, coupled with the decline in volume, these subsidies have increased over the last year. A crude estimate of the cost of these subsidies can be obtained by multiplying through by the volume marketed by crop. The results show $2 M U.S. for tobacco and tea, and the same for cotton; about $3 M U.S. for cassava and sorghum, assuming all is sold at that price; and up to $25 M U.S. for maize or more depending upon how much is purchased. An additional consumer subsidy was given for maize flour, running in the neighborhood of $10 M U.S.

Of the cost of marketing and processing, a large proportion is spent on personnel costs, for salaries of extension agents and buyers, for staff housing and training, and for transportation. These are fixed costs and hence, increase on a per unit basis when the volume processed declines. The level of staff and administrative costs also varies according to the

degree of value-added processing and by the value per kilogram of final product. Hence, these costs are most onerous for the cotton industry, plus sisal, cashews, and the food crops. Tobacco, tea, coffee, and pyrethrum appear to be able to absorb these costs more easily, but the burden of taxation for the extension services is falling on the organization all the same. The exact details of the total value of extension service costs should be calculated in order to explore the idea of shifting these costs to the development budget rather than financing these subsidies through over-drafts from the Commercial Bank of Tanzania.

The following figure demonstrates what has occurred in the parastatal operations. The total costs for extension have increased over the last few years, but as the volume declines this represents a very high proportion of total costs. If a commission for services could be awarded the parastatal, this additional income could be passed on to the producer in the price.

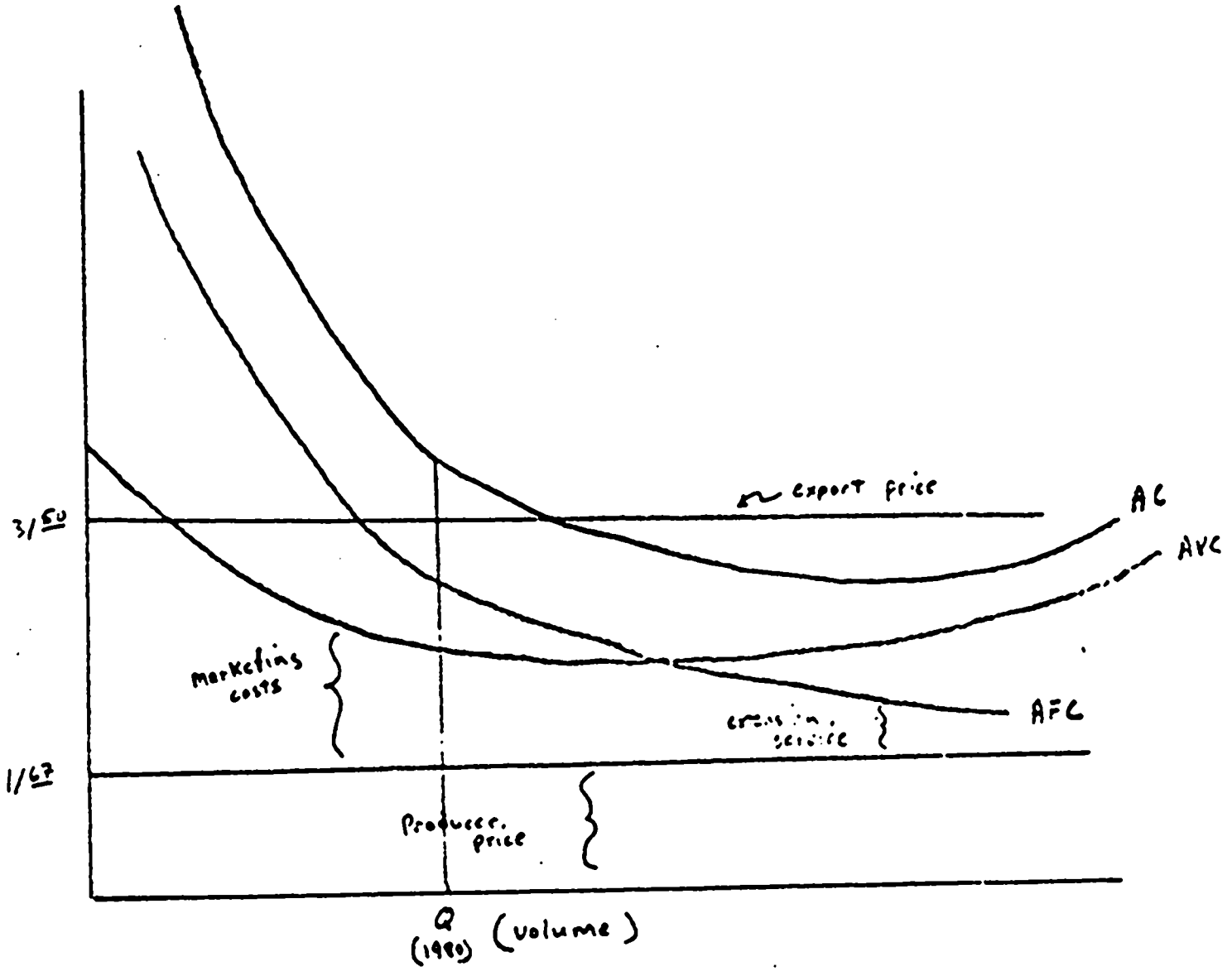


Figure 7. Parastatal Marketing Cost Structure

Variable costs reduction cannot do much. A 10% increase in efficiency in variable costs leads to 4% reduction in total costs whereas shifting costs of extension, or 50% thereof as commission for services, leads to 30% reduction in costs.

2.25 The Special Role of the National Milling Corporation

The preceding section has described the general picture of the crop parastatals. However, the National MillingCorporation plays a significantly different role. Since the early seventies, Tanzania adopted a safety-first production system to avoid against famine due to drought by providing a floor price and buyer of last resort for the inferior demand drought resistant crops. These include cassava, sorghum, millet, and pigeon peas. The initial idea was to guarantee minimal returns for these crops, thereby insuring that a sufficient acreage would be planted to them each year, to the point where even if the rains were lacking, production would still cover subsistence needs. For the most part, this policy has worked well. Even during low rainfall years there has been a surplus of these crops at the floor price in effect. This has led some to consider terminating this policy. However, no sooner would one drop the policy of buyer of last resort than another drought would sneak up. The only way to insure excess acreage in these crops is to maintain the floor price and purchasing policy. The management of the surplus is another matter altogether. A strategic reserve, of a given number of months' consumption, is not necessary under this policy except for the urban populations. But since consumption preferences of these populations is towards maize, rice, and wheat, stocks of the inferior crops serve no purpose. Nevertheless, since the NMC is absorbing these stocks even in low rainfall years, presumably a lower retail price would stimulate some increase in consumption even in the urban areas. Obviously further analysis is required to understand more fully the role the NMC plays in providing food security. Not only are the actual supply and demand figures required but a theoretical analysis is also needed to determine the long-run implications of such a policy before recommendations can be passed on to decisionmakers.

III. Policy Options for Solving the Financial Crisis

From the preceding presentation of existing cropping patterns and improved technology potential, several policy incentives are available to the Government to stimulate more rapid response rates. However, the expected impact of these alternatives varies widely by crop grouping. Moreover, some of these techniques are expected to generate results in the short-run while others have a more long-run time frame. The principal policy alternatives for the short-run include raising producer prices, price supports, export tax relief, import duty concessions and allocating additional licenses, input subsidies, devaluation, and the reform of parastatal operations and financing. The long-run options are more interventionist in nature, in the sense that they require investments and research over a long-term time horizon of up to ten years before the real impact of the programs will be felt. These programs include designing more efficient input supply systems, research and extension in cropping systems, developing workable rural assembly markets, increasing the capacity utilization within the processing industry, establishing small-scale irrigation schemes, and financing specific export crop rehabilitation programs.

3.1 The Expected Impact of Short-Term Solutions

3.11 Raising Producer Prices and Price Supports

It is common knowledge that an increase in producer prices will lead to an increase in production, but the rate of production response over time varies by crop. Only by substantially raising the volume of exports will the foreign exchange deficit be reduced. The question then becomes, "What price support options can be introduced which will lead to significant spurts in export crop volume over the short-run?"

To answer this question, a review of each crop group with export potential will be carried out. The principal crop in the food group is the swing crop, maize, which could be exported in years of surplus production. Since it is already highly subsidized, further subsidy through price support would not lead to a fully compensated production response. Hence, it is not recommended to increase the price support to maize producers.

With regard to drought crops, it is fairly well recognized that stimulating production even further is not necessary. Moreover, because the floor price plus handling costs are greater than the export price, these crops are not viable foreign exchange earners. However, perhaps a caveat should be raised that, when a large surplus emerges on account of good rains and because the NMC countinues to guarantee the floor price for these crops, they should be exported as livestock feeds to earn whatever foreign exchange they can to help contribute to reducing the deficit. Since the policy of avoiding famine is like a fixed cost to the agricultural sector, export earnings from these crops in those bumper crop years will certainly assist in reducing the balance of payments deficit. However, further support for these crops is not necessary.

The edible oil crops present an entirely different picture. Although solid information on processing, marketing, and handling costs is not available, the strength of the export price is such that there appears to be room for raising producer prices. Since these crops are also somewhat drought resistant and the milling capacity is in place but under-utilized, this policy option appears to look quite favorable. Also, the short-run implications would be significant. These crops use very little purchased inputs and are grown on a seasonal basis, and hence the constraints to increased output are minimal. However, some research is required to increase their yield potential. Lastly, the oils can be exported in a

value-added form so that the export earnings would not only reflect production value but also processing value.

Sisal presents yet another case. 50% of sisal production currently stems from hedgerows. Farmers have been reluctant to harvest their shoots because the assembly markets are too far distant from the fields and there is the risk of delays in payments. Secondly, villagization has moved the people from their fields and so what once was a one-way trip to market is now basically a two-way trip. However, the government has recently made an attempt to increase sisal harvestings by taking off the export tax and passing some of this relief on to the producer by raising producer prices. If the farmers receive this price increase, it is expected that hedgerow harvestings will rebound and significantly increase the volume of export earnings from sisal. Farmers returns to land, labor, and cash inputs will increase over 70% if producer prices increase 50%. Roughly the same situation holds for cashews. Many trees were abandoned during the initial stages of villagization, and with the risks of marketing, nut collections have fallen off. If the projected price increases suggested by the MDB are implemented, harvestings should increase significantly. Since a margin still exists between the export and local price, passing these earnings on to the producers should be possible. However, in both the sisal and cashew industries, the plants and trees have passed their optimum output levels. There have also been some disease problems in cashews. Both crops need rehabilitation and new plantings. Although a significant impact could be generated in the short-run in terms of increasing the rate of harvesting on existing plants, new plants are required to sustain this volume of exports.

The annual export crops considered in this report--namely, cotton, tobacco, and pyrethrum, each are mired within their own respective set of constraints. Introducing price supports for cotton, given the fact that current producer prices plus marketing and processing costs are greater than the world price, should lead to significant increases in production if the risks of drought and floods, plus the delay in payments, could be overcome. Without dealing with these constraints, the expected response would fall short. Tobacco and also pyrethrum, on the other hand, have experienced growth in output over the last decade. But caution is required with respect to tobacco production because of the expected market decline when Zimbabwe begins marketing their production again. According to the MDB reports, there seems to be problems in curing and maturing the tobacco. Given these processing and marketing risks, the outlook for tobacco looks bleak. Pyrethrum production was increasing rapidly in the mid-seventies but has since fallen off. Prices look good, return rates are high, but there have been some problems in the management of the pyrethrum parastatal. During our visit, the Minister of Agriculture replaced the executive management for illegal administrative costs. Once again, the problem of parastatal management surfaces. Increases in producer prices could be introduced but are probably less important than improved efficiency of flower collections, drying, extractions, and payments.

Coffee and tea seem to be doing well, both from a parastatal efficiency of operation viewpoint and in terms of producer prices. The major difficulty arises from slippages across the border into Kenya of Tanzanian coffee beans. In addition, there is some indication of delays in full payments to coffee producers. To deter the former, the Government has eliminated the export tax and increased producer prices 80%.

This is expected to stop the flow of coffee to bordering nations. However, if problems of the management of payments is not addressed, severalfold increases in producer prices will mean nothing.

3.12 Export Tax Relief

In order to provide the margins for increasing producer prices, the Government can offer export tax relief. During February, this was done by eliminating the export tax on sisal and coffee and the producer tax on tobacco. At the same time, to offset somewhat the loss in revenues, the consumption tax on spirits and tobacco was increased. The effect of the tax relief was directly passed on to producers for coffee and presumably will be passed on for other crops as well. This measure should have an immediate effect on sisal harvestings of hedgerows, of official marketings of coffee, and perhaps some response in acreage for tobacco. However, the effect in tobacco may be lagged several years because export earnings are not received until 18 months after harvest, after the curing, maturing, and blending takes place.

Cotton, cashews, tea, and pyrethrum could also offer export tax relief, and thereby generate higher producer prices with expected concomitant production responses. However, it should be noted that once the easy opportunities are obtained in terms of increased harvesting of existing perennials, sustained expansion rates must come from production rehabilitation or new plantings, both of which will generate benefits only after several years' growth before maturity. This is true for sisal, cashews, coffee, and tea.

3.13 Input Subsidies

Raising producer prices reduces the risks of production and marketing in the sense that it increases net profit on value product

without increasing its variance. It does not, however, reduce the amount which could be lost in the case of a complete crop failure (or lack of or delay in actual payments for the produce marketed). Subsidizing inputs, on the other hand, lowers the risk directly regardless of what happens to prices because it cuts the cost outlay. When costs are zero, risks are zero with virtually all risk measurement techniques. In Tanzania, most inputs are already generously subsidized. For maize and cotton, the subsidy reaches almost 60%. However, since the use of purchased inputs is minimal under traditional technology levels for these crops, the impact is marginal. But since the new technologies require quite an increase in input levels, over 5 times higher for the improved technology levels even with the 60% subsidy, it is clear that this policy alternative could play a major role in the rate of new technology uptake.

Although the smallholders growing maize, cotton, drought and oil crops have utility functions which lead them to be substantially risk-adverse, the smallholders producing strictly for export cannot absorb much more risk either without feeling the pinch. Luckily, many of the cash crops are grown under fairly riskless environments. This is true for tea, coffee, sisal, pyrethrum, and perhaps cashews. When the variance is low, so is the risk. Nevertheless, the absolute value of the expected loss function for the cash crops is greater than it is for maize or cotton, as shown in Table 6. Notice the almost direct linear relationship between total input costs and the absolute value of the risk. Hence, input subsidies will lower this risk and lead to faster rates of adoption of the higher level of inputs. On the other hand, input subsidies are costly. These inputs themselves require foreign exchange, and if totally

subsidized, would have to be paid for out of government expenditures. Only if the subsidy would lead to rapid yield increases through higher adoption rates would this be a viable alternative. Maize, cotton, and pyrethrum could be the crops with the best potential.

3.14 The Case for Crop-Insurance

Maize and cotton require substantial increases in material inputs in order to significantly increase yields. Yet these two crops are principally grown in areas where rainfall varies considerably. Hence, yields are reduced, due to lack of moisture or to flooding, in some years for cotton. With such extreme levels of variation, farmers avoid costly outlays for material inputs. As a result, even when the weather is "good," yields are relatively low. In this kind of situation, crop credit insurance can serve to increase input use levels. If the correlation between yield and rainfall can be determined, a system can be developed to forgive the credit debt in years of low (or excessive) rainfall even without field inspections, simply by measuring rainfall levels. This sytem is actually functioning for these crops in a semi-arid area in neighboring Kenya in a pilot project. In establishing such a scheme, the principles of crop credit insurance should be followed, and could be provided in terms of technical assistance from the FCIC within the USDA. The direct impact of crop-insurance would be to speed up the rate of higher input use for these two crops as well as insure that the smallholders continue to seed an adequate proportion of their land to these crops each year. In a sense, this is a form of input subsidy but the cost is only brought to bear on "bad" years. The insurance premium could be subsidized or charged as an inscription fee to the borrower. Either way, it would guarantee the farmers credit worthiness to commercial or

government credit institutions. In fact, an insurance program would reduce the need for such high subsidies on inputs. The return rates in Table 8 show that returns to purchased inputs are well above the opportunity cost of capital and, hence, from an economic efficiency point-of-view, do not require subsidy. It appears to be the risk of production and the uncertainty of marketing that is preventing agricultural technology adoption. Substantial interest in crop-insurance exists in Tanzania in the USAID mission and this issue should be pursued in the Phase II Title III followup visit.

3.15 Devaluation

As it has been pointed out above in the section on prices, an increase in output value should lead to an immediate increase in output of sisal and cashews from increased harvestings, and from coffee because of less leakage across the borders. However, for the crops which account for the largest proportion of crop output, devaluation would only have the effect of raising the cost of purchased inputs, hence, increasing risks and lowering profits and returns, and consequently, acreage seeded. Moreover, devaluation would be inflationary and would work against the Government's drive toward equitable social welfare. Consumer goods would cost more, and the vital transportation industry would suffer adversely because the already high priced oil, vehicles, and spare parts would experience direct price increments related to the degree of devaluation. Nevertheless, the shilling is overvalued; some form of devaluation or exchange rate adjustment is necessary. The recent cutback on export taxes on coffee with the subsequent price increase to producers implicitly recognizes this imbalance (coffee producers sell for Kenyan shillings and purchase Kenyan consumer goods to bring back to Tanzania), and shows the Government's desire to attack this issue.

Although devaluation would not directly solve the financial crisis in terms of earning sufficient extra foreign exchange to balance the trade account in the short-run, 3-5 years, devaluation would lead to a restructuring of the economy vis-a-vis international price relationships. Tanzanian enterprises dependent upon costly fuels and imported raw materials would find themselves at a comparative disadvantage with devaluation whereas processing industries using locally produced primary goods with low energy costs and little imported machinery would become the most profitable. This would lead to an improved industrial base over the long-run and, hence, should be considered seriously. If the technique of devaluation is politically unpalatable, perhaps a finely-tuned system of taxation and duties could approximate the same effect. Even a bonus for export shillings could be awarded to producers, thereby achieving the same effect. Or devaluation could be carried out along with 100% input subsidies to maize and cotton producers. Several combinations could be designed, many of which could mask the unsavory taste of outright devaluation.

With regard to risks as measured previously, a 50% devaluation would increase the absolute value of risk 32% for coffee and tea, and 23% for cotton, due to the correlating increase in the cost of purchased inputs. This compares to a 41% increase in the risk for maize.

3.2 Long-Run Policy Options

3.21 Crop Development Programs

Since the mid-seventies it has been shown that farmers adopt new technologies only when (1) the improved technologies significantly raise yields and (2) the major socio-economic constraints have been overcome. Too often researchers and development experts assume the first condition has been met and never consider the second. For example, the yield increases for groundnuts and sunflower suggested by the MDB are not substantial enough to induce much higher input levels. In addition, the risks associated with cotton production outweigh the income increments expected

The proposed cropping systems program is designed to carry on the research and development work initiated under the National Maize Program, by expanding the coverage in area studied as well as opening up the number of crop and crop combinations considered. This system combines the essential aspects of agronomic research in determining crop requirements with the basic elements of socio-economic analysis in identifying farmers' limitations. When an inconsistency surmounts in the sense that a particular requirement demands more resources than those which fall within the farmer's limits, thus creating a constraint, the researchers will either adjust the bio-physical requirements (reduce the fertilization rate and number of applications) and/or expand the farmer's limitations (subsidize the inputs or provide crop-insurance). The system by definition recognizes the multiple cropping patterns indigenous to the area. The approach is designed to determine which combinations of crops and activities are conducive to greater food security and income generation and to look for fine-tuning adjustments which can eliminate unnecessary losses and provide for safe income increments. This type of program has been field-tested in Puebla, Mexico, and Caqueza, Colombia, and has been the focus of substantial investment and research at IRRI, CIAT, and IITA. The World Bank and USAID have supported this kind of program in many countries in recent years and are presently financing the expansion of these programs in both Mexico and Colombia. The expected impact from farming systems programs takes several years to materialize, but the spread effect can be substantial and can be achieved within the existing price structure.
Moreover, in its drive to develop appropriate technologies it recognizes the existing limitations of the existing environment, in terms of both physical and human resources, and achieves its effects within this framework. The system works to create an environment for change rather than imposing conditions for change from outside.

3.22 Input Supply and Rural Assembly Markets

In order to increase yields in semi-arid agriculture, resource increments must be applied in some form. This usually means higher rates of fertilization and using more dust and sprays than is customary within subsistence agriculture. If higher levels of inputs are to be used, such items must be delivered to the local community where the farmers live in a timely fashion, and a mechanism must be designed for financing them such as credit or subsidies.

The program, outlined by the Tanzanian Government and supported by USAID, is to establish village input supply and marketing centers, on a cooperative basis, to include storage capacity. In addition, assistance has already been planned for the Tanzanian Rural Development Bank to supply credit for farm implements and farm and village investments. Provisions are also made for the supply of parts and materials.

By passing the responsibility for the marketing function from the local representative of the parastatal marketing authority to the village assembly cooperative, it is hoped that the institutional uncertainty enveloped in the farmer to marketing board interface will be greatly reduced. This will presumably have the largest impact with respect to sisal, cashews, cotton, and oilseed production. The result will be a reduction in the producers perceived need for a risk premium and will hence increase the farmers' net returns.

3.23 Improving Capacity Utilization of Agricultural Processing

With the shift in taxation of extension services and the improvement of efficiency in parastatal operations, the unit costs for marketing and processing will decline. As these savings are passed on to producers in terms of higher farm-door prices, the volume of production will increase,

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leading to a higher utilization rate for installed processing capacity. Plant expansion is required in some specific commodities, such as tea, for example, but for the most part, especially in vegetable oil processing, the capacity is already installed.

Because of the nature of the agricultural commodities produced by Tanzania, there is great scope for value-added processing. This allows Tanzania to earn up to 3 times the unit value of her exported products than if the raw material were exported without transformation. Such a policy should be encouraged and supported. Some kind of management assistance should be allocated through the PL 480 agreement to each of these industries in order to increase the efficiency of their operations.

3.24 Small-Scale Irrigation

The team report mentions the potential for developing small swampy areas or depressions, known as valley bottoms, into small-scale rainfed irrigation systems. Such infrastructure investment is not necessarily capital intensive but relies heavily on labor-intensive construction activities. New techniques for small earth dams, subsurface dams, bench and cutoff terraces, and water harvesting methods are particularly suitable for much of the country's semi-arid regions as well as the Southern and Western humid areas. Moreover, the development of these last two areas would take advantage of the present infrastructural development now in place, namely, the TAZARA railway and the TANZAM highway.

Although development in the Southern and Western portions of the country have been hampered by the presence of the tsetse fly, it has been shown that proper bush clearing will reduce its incidence to tolerable levels such that human population can survive. With the influx of human settlements, the fly can be controlled. This development potential should be explored more fully.

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3.25 Export Crop Rehabilitation

In order to sustain the growth of export crop marketings, existing plantations must be rehabilitated along with an expansion of new plantings. Such a program has been vigorously pursued for the sisal industry, but tea has been hampered by the slowness in developing expanded processing capacity. Over the long-run, cashews and coffee need rehabilitation and expansion as well. In terms of cotton production, the risks of production and the management of marketing and processing must be dealt with.

3.3 Effects of Policy Options on Adoption Rates

The aforementioned policy options, both short- and long-run, will affect adoption rates of improved technologies differently for each crop group. This shows that targeted policy measures would appear to be more efficient and appropriate than across-the-board options.

In the first case, price support or devaluation can create a jump in earnings for sisal, cashews and coffee. After 5 years, the increase in production will come principally from rehabilitation and new acreage. Input subsidies are most important for speeding up the adoption rates for food crops. The drought crops will continue to protect against famine if the floor price is maintained but significant increases in productivity or acreage is not required. However, the oil crops, including cotton, will benefit most from price supports (or devaluation) in the early stages and crop research in the latter half of the decade if these efforts can be combined with a risk-absorption program such as crop-insurance or input subsidies. Hence, targeting price supports, input subsidies, crop-insurance, credit, tax relief, marketing reform, and import concessions will have the greatest effect in the short-run, and specific programs in crop research and development, input supply, credit, storage, and marketing cooperatives, irrigation and export crop rehabilitation will be most important in the long-run.

IV. Agricultural Planning and Investment

There is much controversy over what has happened in terms of investments in support of export crop production over the last decade. There is no doubt that the value of agricultural exports as a percentage of GDP is less in 1980 than it was in the late 60's. But several things have happened during this period which distort the picture. If output varies directly with rainfall, and this variation is increasing, investors would be well-advised to cut back on their total level of outlays. Instead, the impression drawn from the somewhat conflicting data is that the absolute value of investments has actually increased over this period for the cash crops as a group. On a crop-by-crop basis, investment levels are unknown. Substantial rehabilitation programs are in progress in the sisal industry, and investments are increasing in tea and tobacco. The current situation in coffee is unknown. The cashew industry is suffering from a disease problem and over-maturity of trees. Cotton is managed on an annual basis as is pyrethrum and investment rates vary according to how the farmers perceive the future. As risks increase, investments decrease.

According to the budget estimates of the new five-year plan, agricultural investments as measured by expenditure levels are expected to double over the current plan figures. Agriculture accounted for 11.5% of the current budget and will take 12.4% of the next budget. With the renewed emphasis on export crop rehabilitation, investments in these crops are expected to increase rapidly. In conclusion, it appears safe to say that after the 74/75 drought, Tanzania did not disinvest from the export sector, but rather was forced to respond to the food deficit issue. In so doing, the recurrent cost budget for the maintenance of export crop production was diminished, and the budget for food crop support was expanded.

During the recovery period, cotton was devastated by floods, while the majority of the other export crops experienced soaring prices. However, these price spurts were abnormalities and did not reflect long-term trends. Hence, investments have risen slowly over this period.

V. Recommendations for Financing

As stated in the team report, Title III food imports could be used to meet short-run and cyclical domestic food shortages, the value of which in terms of local currencies generated from their sale, could provide resources to the government for investments to expand crop and/or livestock production. The preceding analysis identifies several areas which the Tanzanians might consider for project development. Upon Tanzania's expression of specific interest, a second phase USDA-AID team could proceed to Dar es Salaam to work out the proposal details and establish the evaluation indicators required for credit forgiveness. The major areas of interest to be explored in the second phase of the Title III design mission are:

1. Crop development programs, as envisioned in the USAID-supported Farming Systems Research Project, which is designed to develop appropriate locally tested, mixed cropping technologies to increase yields within the limits of the smallholders existing resource base.

2. Buffer institutions which would be designed to overcome bio-physical or socio-economic constraints to new technology adoption, such as crop-insurance, water harvesting, or soil and water conservation programs.

3. Rural assembly market development, which is the essence of the village stores and supply depots system presently under discussion.

4. Farm inputs delivery systems, to handle farm implements and machinery, materials for storage facilities, and other spare parts, as well as covering a proportion of the costs for targeted subsidies of crop inputs.

5. Price support for annual cash crops which have relatively high supply elasticities, such as cotton and pyrethrum.

6. Recurrent cost assistance, to pick up on-going projects of a general support nature where donor financing is being phased out, namely, the National Maize Project and the Seed Multiplication Project.

7. Food security policies in collaboration with the national milling corporation in order to maintain floor support for drought resistant crops while at the same time provide subsidized food for urban consumers. Title III local currency funds could be used for the price support activities, for inventory carrying costs, or for financing the losses incurred from resales at prices which are less than full costs. This could be done by Government paying a commission for these services.

8. Assistance for a planning team in the Ministry of Agriculture for project preparation and appraisal in the agricultural sector.

9. Support to crop parastatals to cover the initial costs to Government of assuming extension, research, and personnel costs of the parastatal operations.

5.1 Policy Issues

1. Export Crops - Cotton, Pyrethrum -- Export tax relief should be sought in order to raise producer prices and assurances should be obtained to insure that payments for produce received are received by producers within a given time span.

2. Export Crops - Sisal and Cashews -- Reduction of the export tax and/or producer price increases should be introduced.

3. Export Crops - Coffee -- Assurances must be made that coffee producers receive their payments within a stipulated time of bean deliveries.

4. Targeted Commodities -- Parastatal costs for extention, research and housing and vehicles for their staff be transferred from annual agency operating costs to the national development budget. Specific crops with substantial potential for immediate benefits from this policy incentive include cotton, sisal, cashews, coffee, and oilseed crops.

5. National Milling Corporation -- Finance the social costs of the food security system through the development budget rather than through deficit financing by overdraft to cover operating losses.

6. National Milling Corporation -- Maintain the subsidized floor price to producers for drought resistant crops but lower the consumer price for the same in the urban markets. This subsidy could combine with a slight increase in sembe (maize flour) prices so as to generate consumption substitution in those years when maize is in short supply but the "inferior demand" crops are relatively plentiful (such as is the present situation).

7. Parastatal Efficiency -- Encourage Government to seriously corsider technical assistance to management for each of the major commodity marketing and processing authorities, through private contracts, with the aim of improving marketing and processing efficiency by reducing unit costs per kilogram of volume handled.

5.2 Evaluation Indicators

The indicators required to assure that the Government actually carries out the proposals agreed upon could be measured directly. The development budget would indicate the level of financing for the Farming System Research Program. A target level could be set and a percentage dispersement rate would have to be demonstrated before loan forgiveness could be authorized. The second recommendation would be hard to evaluate because the nature of the new institutions could not be defined until the farming system program could identify the constraints and design the institutional adjustments. It could be agreed that once established, the new institutions could fix, in consultation with Government, the exact measurement variable. Rural assembly markets could be evaluated by the

flow of produce through storage and the quantity handled by the marketing agents. In terms of program assistance, the fourth recommendation refers to input supplies. The policy incentive could be evaluated by the volume of sales or credits made by the TRDB with the support of the Input Delivery Project.

Price support is relatively simple; measure producer prices in selected sample regions. Recurrent cost outlays to continue operation of on-going projects could easily be verified at the national level and at the project level. With regard to food security, the payment of the suggested commission to NMC would have to be verified, the accounting procedures would have to be changed on the books, and the floor prices for the drought crops would have to be maintained but with a reduction in consumer prices for these commodities. Recurrent cost assistance to parastatals would involve Government outlays at the national level which could easily be monitored. Since the transfer of financing for these activities may only be temporary, a phased indicator would be necessary.

The policy measures suggested above could easily be verified by monitoring national proclamations vis-a-vis prices and taxes, but with respect to the timeliness of payments received, some form of producer survey would be required. Numbers 4 through 6 would require an expost evaluation of NMC's operations on an annual basis, perhaps carried out by the task force currently investigating that agency. Lastly, the MDB currently reviews each commodity and its marketing board's functions, including an analysis of unit costs. These reports would be sufficient to evaluate this policy component.

VI. Summary

This report has reviewed the performance of the agricultural sector of Tanzania during the decade of the 70's, a period fraught with excessive internal and external economic shocks. Throughout this period, Tanzania has reacted swiftly and apparently correctly in order to protect against her primary preoccupation, namely, the adverse effects of drought on food consumption. In the process, the export crops have not been allowed to expand in terms of increased investments due to the shortage of Government revenues and, hence, the value of export earnings has not kept pace with the rapidly rising import bill. Exacerbating these conditions even further has been the drain on the national accounts caused by support of the Ugandan liberation foray.

In spite of this dilemma of severe shortages in foreign exchange, Tanzania appears to be in a favored position to regain her rate of growth of export earnings from the agricultural sector if certain short-term and long-run policy measures are pursued with vigor. Principal among these options is the determination to reduce inefficiency within the floundering parastatal marketing authorities so that per unit cost reductions can be passed on to producers so that increased output will be stimulated, thereby further reducing per unit costs. However, in order to avoid the necessity of allocating foreign exchange for food imports, the safety-first famine avoidance doctrine of the NMC must be adhered to, with slight policy changes with regard to the management of inventory stocks annual drought resistant crop purchases. Inventory stocks should be kept at a minimum; the insurance against famine comes from large acreages seeded during dry years, not from carry-over of strategic reserve stores of grains.

Title III could play a major role in protecting against cyclical food shortages during the next 3 to 5 years of the adjustment period, from drought recovery to a sound strategy of food security coupled with maximum efforts to provide export crop incentives. The principal funding activities towards which the local currencies generated would be directed, would be for recurrent project and parastatal costs during the transition period, until the balance of payments and foreign exchange deficits could be eliminated.