2.5 Impact of State Disengagement from the Management of Agricultural Production in the White Nile Pump Irrigation Schemes in Sudan

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Introduction

Most discussions about privatization and turnover of irrigation systems have focused on the transfer of the management of public irrigation schemes to water users organizations. There has been little discussion of the changes in the provision of agricultural support services which are necessary to make investments in operation and maintenance more cost-beneficial to farmers and enhance the performance of irrigated agriculture.[1]

Until recently, the agricultural sector in most developing countries was substantially supported by government. Farmers received subsidies on inputs, price supports for their products and state agencies have been responsible for the procurement and distribution of all agricultural inputs, irrigation pumps, machinery and equipment and marketing of produce. This has particularly been the case in Sub-Saharan Africa. A World Bank (1981) study revealed that in more than 60 percent of the African countries, the provision of inputs and services were monopolized by government or parastatal agencies. It is well documented that most parastatal agencies have been failures: inefficiently managed, inadequately controlled, debt ridden and offering poor products and services to their clientele. They have been identified as a major contributor to the poor performance of African agriculture (egs. World Bank, 1981).

In recent years, governments in many countries (egs: Senegal, Sudan, Bangladesh) in which government institutions were the principal providers of agricultural inputs and services have withdrawn or curtailed the scope of state provision of support services to farmers, and have transferred this function to private companies and farmer organizations.[2] Yet, very little known about the effect of this change on the efficiency in the delivery of support services, the cost-effectiveness to farmers and its impact on the performance of irrigated agriculture.

This chapter presents the results of a case-study on the consequences of state disengagement from the provision of support services for the irrigation schemes in Sudan. These schemes have had dual state management with parastatal agencies managing agricultural production[3] and the Ministry of Irrigation managing the irrigation infrastructure (operating and maintaining all pumps, canals and the distribution of water up to the field outlets). Farmers' role was restricted to mobilizing labor and supervising cultivation activities on their holdings.

Parastatal management agencies in Sudan have often been criticized for the late delivery of production inputs and for delays in the performance of services, such land preparation, pest and disease control and harvesting, which led to a steady decline in the performance of the irrigated sector. [4] Moreover, these agencies had accumulated substantial debts and were a financial burden on government.

In 1991, the Government of Sudan (GOS) took initiatives to reform the management of agricultural production in the irrigation schemes. It began with the downsizing of the White Nile Agricultural Schemes Administration (WNASA)[5] which administered the pump schemes located along the White Nile (Figure 1). About 70 percent of the staff were laid off and its administration was abruptly withdrawn from all but 38 of some 175 irrigation schemes. The government expected farmers in the schemes excluded from parastatal management to form their own management organizations or to entrust private companies to manage agricultural production. However, the ownership, and operation and maintenance of the irrigation facilities were retained by the state.

By the end of 1994, one company had taken charge of 16 schemes relinquished by the WNASA. Thirty three schemes were brought under an organization set up by farmers on the initiative of the provincia administration. The fate of the remaining schemes was unclear: many were abandoned; others remainec partially functional and limited to growing sorghum under rainfed conditions.

The main objective of this study is to compare the performance of the three modes of management of irrigated agricultural production: private company management, farmer management and parastatal management which emerged following the partial withdrawal of the state from the White Nile pump schemes. The second aim of this study is to examine whether, under the prevailing macro-economic and political environment in Sudan, management of agricultural production in the White Nile schemes by farmer organizations and private company management is financially viable ?

The fundamental premise underlying the study is that the shift from public to private provision of inputs and services is a necessary but not sufficient condition to improve support service delivery and the performance of irrigated agriculture in a situation where the state has dominated an inefficient agricultural sector. The study contends that such actions must be accompanied by supportive macro-economic and institutional reforms which would enable the freedom of entry to private providers of services, foster competition, and curtail rent-seeking behavior and political manipulations by private actors.

The remainder of this chapter is organized as follows: The next section gives an overview of the state disengagement policy in Sudan and its antecedents. The section that follows provides a comparative analysis of the performance of the irrigation schemes under the three modes of management. The next section examines the financial viability of agricultural production in the White Nile schemes under the three management modes. The final section gives the conclusion of this study.

Policy on State Disengagement and its Antecedents

Economic and political environment

Due to inappropriate economic policies, a costly civil war, deterioration in the terms of international trade and natural calamities, the Sudanese economy has been moribund for a better part of the period since independence in 1956. It has degenerated at an alarming pace since the mid 1980s. GDP declined by some 14 % between 1992 and 1993. There is a critical shortage of production inputs and energy. Inflation was estimated to be 250% in 1993 (IFAD, 1993).[6] External debts are substantial.[7] Foreign exchange reserves have been exhausted and exports have declined to half of previous levels.[8] The exchange rate policy, which had been the bane of the country's economy, remains in a state of flux, causing confusion and uncertainty in national markets.

Political instability has been a hallmark of the nation since independence. Even at present the political landscape is murky. The "Islamization" of the economy and emergence of powerful religious-political groupings who have a controlling interest of key economic institutions adds to the complexities in the political environment[9]. Although official pronouncements espouse economic liberalization and free market policies, the changes enacted so far are cosmetic. There is little evidence of the state relaxing its political control over the economy. Political patronage is a key factor for private sector participation in economic affairs. These circumstances have resulted in the weakening of mainstream government institutions and the erosion of relations between the state and a larger part of the civil society.

Policy of disengagement

The basic policy framework for state withdrawal from management of agricultural production in White Nile irrigation schemes was drawn up under The Economic Salvation Program of 1990-93. This program symbolized a radical shift from the tradition of state dominance and was designed to provide a greater role to private actors and market forces to achieve social and economic goals.

Regarding the irrigated sector, the key provisions of the policy are as follows:

1. In the major gravity irrigation schemes (Gezira, Rahad and New Halfa) facilitate greater participation of farmers in scheme management by appointing farmer representatives to the Board of Directors of the parastatal agency managing each scheme. Ancillary service units of the parastatal agency (i.e.; machinery unit, Gezira light railways, ginnery) were to be privatized.

2. Divestiture of parastatal agencies managing agricultural production in the pump schemes and transfer of this function to private companies and farmer organizations.

3. Pump schemes were transferred to private companies only if farmers concurred with the terms and conditions offered by the company to manage agricultural production.

4. The period of management contracts was for one season or one year depending on the crop.

5. Private companies managing the schemes had to cultivate the crop and the variety specified by the Ministry of Agriculture and pay the stipulated water fee to the Ministry of Irrigation.

The policy was implemented in wheat season of 1991-92 with the partial divestiture of the White Nile Scheme administration and transferring the management of some of the schemes to private companies and farmer organizations.

Post-Turnover Management Modes

Private company management

To date, private company management has been limited to the sixteen schemes vested with the White Nile Holdings Company. This company began operations in 1991, inheriting many of the staff laid off by the parastatal agency. Most of the schemes are devoted to cotton. The company exercised stringent criteria in choosing its schemes, selecting only those in which facilities were in good order and soils were fertile. It avoided schemes where the farmers' union was strong and chose only those schemes where farmers were willing to negotiate terms and conditions directly, thereby bypassing the national farmers' union.

The company operates the scheme on a profit sharing basis. Under this system, the company provides all inputs, arranges for land preparation and harvesting, and advances a small amount of cash to farmers. After harvest, the company keeps part of the produce, equivalent to the value of the inputs supplied plus administration costs, water charges and other taxes and levies. The remainder of the harvest is shared on the basis of 54 percent to the farmers, 42 percent to the company and 4 percent credited to a social services account.

The participation of farmers in management is limited to representation on production and advisory committees. The company is not obliged to undertake long-term rehabilitation of its schemes and is entitled to withdraw from a scheme if it finds that major investments are required.

At present, private sector administration reflects the contradictions inherent in Sudan's peculiar blend of privatization and continuing state dominance. The company operates according to commercial principles, to maximize profits, yet farmers' activities remain strictly regulated by the company. Decisions about cropping patterns, cultivation methods and the use of inputs are all controlled by management. This system differs little from the past: all that has changed is that control over farmers' activities is now exercised by a private company instead of a parastatal agency.

Farmer management

Farmer management is confined to the Duiem Province where the provincial government set up an organization to take charge of 33 schemes which were abandoned by the parastatal agency. The schemes are grouped into ten units federated at the provincial level. Each unit has its own Board of Directors, consisting of five elected farmer representatives and a nominee of the Farmers' Union.

Production relations in the farmer managed schemes are more liberal than in under company management. There is limited freedom in the choice of crops. Farmers can make their own financing arrangements, buy inputs on the open market, and sell their produce where and when they wish. Management can organize loans through banks for those farmers unable to arrange their own credit.

Steps taken by farmers at Dueim to set up their own management organization are unique. For the first time in Sudan, farmers have taken full charge of the agricultural management of irrigation schemes. Key factors enabling them to do so were the presence of a strong local branch of the farmers' union and supportive political leadership. A third important factor is that the Dueim farmers are not settlers but were once freeholders of the land they now farm as tenants. They are currently campaigning for the return of ownership for their land. This is an example of the importance of property rights in supporting management turnover.

The Dueim system represents Sudan's first real step towards fully privatized, farmer-managed irrigated agriculture. It may prove a useful model in the country's continuing search for viable forms of farmer management.

Parastatal management

The future of parastatal management remains unclear. Downsizing was intended as a prelude to complete closure, so the agency has every incentive to succeed. Under the terms of the downsizing it was able to retain the more productive wheat schemes, giving it some advantage over the other management modes.

Following downsizing, the White Nile Agricultural Schemes Administration (WNASA) is expected to finance its own activities. This it attempts to do through the collection of an administrative fee from farmers. Revenue is also generated through the supply of inputs and from the purchase of wheat from farmers at prices well below those on the open market.

The agency has not altered its basic management system. As before, it supplies all inputs on credit, recovering these in kind after harvest. The pressure to become self-financing has, however, led it to adopt cost-recovery procedures that place farmers at a disadvantage. The proportion of the crop to be

retained by the agency is calculated according to prices at the time inputs are supplied. Given Sudan's high rate of inflation, the agency is able to make a substantial profit in this way.

Performance Results of Schemes Under Alternative Modes of Management

This section compares the performance of the three management modes in terms of: a) efficiency in the delivery of agricultural services, b) cost effectiveness of inputs and services, c) agricultural production technology and productivity levels, d) quality of irrigation services, e) productivity of irrigation water and d) relative water supply. In addition, an assessment is made of the impacts of the changes in production relationships on tenant incomes. The analysis is based on empirical evidence obtained from a sample of farmers in six selected schemes: two schemes (Rawda and Guli) under parastatal management, two schemes (Tawila and Umganeem) managed by a private company and two schemes (Salati and Almagam) managed by farmer organizations.[10] Based on this analysis and drawing on evidence from another study[11], the final section examines whether under prevailing conditions, farmers have the financial capacity to take over the administration of the schemes.

Efficiency in the delivery of production inputs and services

Official expectation was that the delivery of support services would improve with transfer of management to the private sector and farmer organizations. This section compares efficiency in the provision of support services in turned over schemes with those under parastatal management on the basis of a "'Service Delivery Performance Index". This index was computed from data obtained from a sample survey of 155 farmers in the six selected schemes, carried out during the wheat season of 1993-94. The index is derived from farmer perceptions about provision of support services. Appendix 2 gives the method of computation of the index. The results are presented in Annex Table 1.

Overall, the delivery of support services by the parastatal was considered by farmers to be superior to that of the private company and the farmer organization. This was primarily because the parastatal agency now concentrates its efforts on a limited number of schemes (38), whereas previously it had to service some 174 schemes. Also, at present, government regulations permit only wheat cultivation in the agency managed schemes, unlike earlier where cotton was grown in addition to wheat. The focus on a single crop enabled the agency to coordinate its services more effectively.

The delivery of support services in the farmer managed schemes ranked the lowest. The administration of the farmer managed schemes is still its formative stages. The organization functions with a skeleton staff, most of whom are on secondment from the White Nile Agricultural Schemes Administration. Another important reason for the poor delivery of support services is that with the withdrawal of state support, farmers have to rely on the inadequately developed private market where critical inputs are very often in short supply. This is particularly a problem in the White Nile area.

The performance of the private company in the provision of support services was mixed. Farmers in one of the schemes (Tawila) were satisfied with the services rendered by the company. In the other scheme managed by the company, farmers were disappointed with the services provided. According to the field staff of the company, management had restricted the level of investments in the latter scheme since its production potential was considered to be low.

Cost effectiveness in the provision of inputs and services

A key argument in support of transferring management for the schemes from state to non-governmental entities centers on the potential for more cost effectiveness of services. This argument is particularly

relevant to Sudan where, given the capital intensity of agricultural production in the publicly managed irrigation schemes, the availability of working capital rather than land or water is a major constraint for irrigated agriculture. Cost effectiveness in the provision of inputs and services is a significant indicator of management performance in this context.

Table 1 shows the average costs of inputs and services provided by the three entities which currently manage the White Nile pump schemes. The total cost of inputs and services in the farmer managed schemes were not significantly different from the parastatal managed schemes. Differences were in the cost of fertilizer and harvesting.

Table 1. Cost of inputs and services by management modes (US $/ hectare) -1993/94 wheat crop

Cost Item	Parastatal Agency	Private Company	Farmer Organization
Production Inputs			
Seeds	$ 22	$ 22	$ 21
Fertilizer	$ 28	$ 37	$ 20
Agrochemical/Spraying	$ 12	$ 25	$ 12
Sacks	$ 3	$ 3	$ 3
Services			
Land Preparation	$ 10	$ 12	$ 10
Desilting Irrigation Canals	$ 2	$ 2	$ 1
Harvesting	$ 10	$ 16	$ 14
Management Fee	$ 2	$ 3	$ 2
Costs/Hectare	$ 89	$ 89	$ 83

Exchange rate - 1 US$ = 425 Sudanese Pounds (LS)
Source: Study survey and scheme administration records

In the farmer managed schemes, farmers curtailed the use of fertilizer. This was partly due to financial difficulties and also because of shortages of fertilizer in the open market. The farmer managed schemes had to rely on the private sector for harvesting, where the charges for hiring harvesters were higher than rates charged by state institutions. The parastatal agency supplied its own machinery to farmers at a lower rate. Farmer managed schemes economized on pest and disease control costs by opting for manual spraying instead of the customary aerial spraying. The agency contained the cost of pest and disease control by using the surplus agrochemicals from the previous season and by permitting farmers to resort to manual spraying.

The cost of inputs and services in the company managed schemes was higher than in the other management modes. The results of a survey carried out by the authors showed that the company levied a higher charge for fertilizer from its farmers than the parastatal agency for the same quantity. The company used its own machinery for land preparation and harvesting but, it had charged the farmers a higher than the rates levied by other private sector companies providing the same service. Although the company was expected to negotiate the costs of inputs and services in advance with the farmer leaders, field inquiries revealed that the farmers were unaware of the costs of inputs and services, even after the cultivation season.

Under the prevailing conditions in Sudan, transaction costs for acquiring inputs and services are substantial. Under state management, the parastatal agency absorbed the transaction costs. In the case of the schemes contracted to the private company, the transaction costs have apparently been transferred to farmer accounts. This is reflected in the higher charges for inputs and services provided by the company.

Field inquiries revealed that less powerful private companies which had earlier taken over the management of some White Nile pump schemes opted out due to the difficulty in obtaining production inputs and credit from state institutions.[12] In Sudan, where private markets are poorly developed and institutions are oriented to serve the public sector, it is unlikely that independent farmer groups could acquire inputs and services at affordable prices without the intervention of a formal management entity.

Agricultural technology

Agricultural production in the major irrigation schemes in Sudan has traditionally been capital intensive. All major operations, such as land preparation, seeding, pest and disease control measures, and harvesting are mechanized. Manual work is confined to thinning, irrigation and cotton picking. These activities are performed by farmers using family labor and supplemented when necessary with hired labor. The choice of crop variety, seeding rate, the quantity and the timing and rates of application of fertilizer and agrochemicals for major crops (i.e. cotton and wheat) are specified by government based on the recommendations of the Agricultural Research Corporation.

Table 2 gives the results of the survey carried out to ascertain the current crop production technology under the three management modes. There were no changes in production technology in the schemes under company management. The company financed the entire cultivation program. The major agricultural operations continued to be mechanized and the recommended amounts of fertilizer applied.. The situation was the same in the parastatal schemes, except for some farmers opting for manual spraying of pesticides instead of aerial spraying. It was noteworthy that a majority of farmers (67%) in the private company managed schemes had not weeded their holdings.

There was a notable shift in production technology in the farmer managed schemes. Investigations carried out in two farmer managed schemes revealed that a substantial number of farmers did not follow the standard agricultural practices (Table 2). Fourteen percent of the farmers had not applied urea fertilizer and some 25 percent had used only half the recommended amount. More than 50 percent of the tenants had not applied any phosphate fertilizer and nearly half the farmers had not weeded their holdings.

Table 2. Crop production technology by management modes - Wheat Crop 1993/94

Activities		Number of Farmers Reporting (%)		
		Parastatal managed	Private company managed	Farmer Organization managed
Fertilizer Application				
Urea	- No Application	-	2	15
	- 50% of Recommendation	-	-	25
	- Recommended Amount	100	98	61
Phosphate	- No Application	-	2	56
	- 50% of Recommendation	-	-	2
	- Recommended Amount	100	98	43
Method of Pest and Disease Control				
None		-	-	4
Manual Spraying		51	52	96
Aerial Spraying		8	48	-
Manual/aerial		41	-	-
Weed Control				
None		16	67	42
Manual		84	33	58
Chemical		-	-	-
Method of Harvesting				
Manual		100	100	10
Combine Harvester		100	100	90

Source: Study survey data

Crop yields

Information on crop yields were obtained from records maintained by the scheme management. Table 3 gives the average wheat yields in the 1993/1994 season the transferred schemes and those under parastatal management. Yields realized in the parastatal schemes (893 kgs/ha.) were slightly higher than the average yield (476-714 kgs/ha) for the White Nile area. Similar yields were realized in the company managed schemes. Wheat yields in the farmer managed schemes (714 kgs/ha) were low and the variability in wheat yield from one scheme to another was high.

The low yields in the farmer managed schemes is apparently due to the fall in agronomic standards following the withdrawal of parastatal management. Also, the more productive schemes were either retained by the parastatal agency or were transferred to the private sector. The schemes which came under farmer management were the less favorable ones.

Table 3. Comparison of wheat yields under three management modes - 1993/94 cropping year

Scheme Management	Average yield per scheme (Kgs/ha,)
Parastatal agency (n = 26)	893 (cv = 50)*
Private company (n = 4)	833**
Farmer organization (n = 29)	714 (cv = 62)

* cv = coefficient of variation

** sample size too small to estimate cv

Source: Survey data and scheme management records

Quality of irrigation service

The recommended irrigation for wheat is eight waterings at 14 day intervals. Each irrigation is supposed to apply 950 cubic meters per hectare (IFAD, 1994). The crop water requirements for a hectare of wheat in the White Nile pump schemes is estimated to be 7600 m3.

The results of the sample survey carried out in six schemes under the three modes of management (Annex Table 2) revealed that the weighted average number of irrigation received by farmers were 5. 38 in the farmer managed schemes, 6.21 and 6.42 in the parastatal and company managed schemes respectively. Only a small proportion of the farmers (30 % in parastatal and 35% in company managed schemes)[13] received the scheduled eight irrigations. None of the farmers in the farmer managed schemes received the full requirement and a majority (54%) received only 4 or 5 irrigations.

Assuming crop water requirements for the White Nile area to be 7,600 m3/ha. the relative irrigation supply was estimated on the basis of the weighted average number of irrigations received by farmers. The results are presented in Table 4. Figures in the table suggest that in none of the schemes was this theoretical water supply sufficient to satisfy crop water requirements.

Table 4. Relative water supply in the three types of schemes

Scheme Management	Weighted Average Number of Irrigations	Quantity of Water Supplied (M^3/ha)	Crop Water Requirements (M^3/ha)	Relative Water Supply
Parastatal Agency	6.21	5910	7600	0.78
Private Company	6.42	6114	7600	0.80
Farmer Managed	5.38	5124	7600	0.67

The results of the farm survey revealed that only 25 percent of the farmers in the farmer managed schemes received irrigation water on the scheduled dates. Whereas, 52 percent of the farmers in the parastatal managed schemes, and 62 percent of the farmers in the company managed schemes reported receiving irrigation water on schedule.

Field inquiries suggest that the quality of irrigation service is superior in the private company managed schemes. The company had a vested interest in ensuring that the schemes it managed received its share of irrigation in order to safeguard its investments. The company had advanced capital for repairing pumps and the maintenance of irrigation canals and deducted the sum advanced from the water charges payable to the Ministry of Irrigation. In addition, the company made "incentive payments" to personnel to ensure that irrigation requirements were satisfied.

The quality of irrigation service in the farmer managed schemes was below desired levels. These schemes did not have an adequate number of field staff to supervise water distribution. Moreover, farmers were preoccupied arranging for credit and production inputs which were in short supply.

Productivity of land and water under the management modes

This section compares the performance of six selected schemes under the three management modes in terms of gross value of output per unit of land and irrigation water supplied. Data is from the wheat season of 1993-94.

Table 5 gives estimates of gross returns per unit of land and irrigation water in the six schemes. Total volume of water pumped in each scheme was estimated on the basis of the recorded number of hours the pump was operated during the growing season (December 1993-March 1994) and measured flow rates. Conveyance loss was set at 10 percent which is the standard used by the Hydraulic Research Station for the White Nile area.[14]

Table 5 indicates that there is no clear relationship between productivity of land and water and the management modes in the six schemes studied. The highest productivity levels were realized in one of the parastatal schemes (Guli). Yet, in the other scheme under parastatal management (Rawda), productivity levels were similar to the schemes under non-governmental management. The change in the mode of management of agricultural production in the White Nile schemes did not have a significant impact on productivity levels.

Table 5. Productivity of land and irrigation water in six selected schemes by management modes wheat crop, 1993/1994

Variable	Units	Parastatal Managed		Private Company		Farmer Organization	
		Rawda	Guli	Tawila	Umganeem	Salati*	Almagam
Command area	ha	221	524	-	215	218	353
Actual irrigated area	ha	171	505	170	200	76	340
Total yield from scheme	tons	153	529	152	142	54	312
Total Quantity of Water Pumped	$000m^3$	1256	2973	1797	1237	-	2003
Conveyance Losses (10%)	$000m^3$	127	297	178	124	-	200
Quantity of Water Delivered	$000m^3$	1129	2676	1619	1113	-	1803
Gross Product Value/ Scheme	mil. LS	10.7	37.0	10.6	10.0	3.8	21.8
Yield / Cropped Area	tons/ha	0.9	1.0	0.9	0.7	0.7	0.9
Standardized Gross Product Value/ha	**$/ha**	**132**	**154**	**132**	**105**	**105**	**132**
Gross Product Value/m 3 of water	**$/m3**	**0.020**	**0.029**	**0.014**	**0.019**	**-**	**0.025**

*note: As data on the quantity of water pumped in Salati was unreliable the productivity of water was not estimated

1 US$ = 425 LS

Profitability of irrigated agriculture

From the farmer's perspective the ultimate measure of success in farming is normally the profitability of the enterprise. Profitability of irrigated agriculture is measured in terms of net returns per hectare under the three modes of management. To minimize distortion in the value of output due to extreme values, the modal yield per hectare was used instead of the average. Output was valued at the prevailing market prices. Cost of inputs and services were the actual amount charged to farmer accounts by management. The cost of hired labor is the amount reported by farmers in the survey.

Table 6 gives the net returns per hectare for wheat under the three types of schemes. The highest net return was realized in the parastatal schemes ($42/ha), followed by farmer managed schemes ($18/ha). The net return in the company managed scheme was a modest $7/ha. This was primarily due to the high cost of production according to the records maintained by the company.

Farmers' incomes

Two factors significantly affect farmers' earnings from irrigated agriculture in Sudan. First is the cost of credit. Second, the high taxation of agriculture. Methods of financing agricultural production changed

following state disengagement from the management of White Nile pump schemes. Farmers in the farmer managed schemes had to finance production from their own resources or obtain credit from the banks under the Islamic principles of banking. The method of financing in the company managed scheme was based on the principles of profit sharing or *musharaka,* which is another mode of financial transactions defined under *Sharia* or Islamic law. Under parastatal management, inputs and services were supplied by the agency and the cost was recovered in kind after harvest. Institutional financing is currently confined only to wheat and cotton. All other crops are excluded from institutional credit.

Farmer income was estimated from two farm models. The first one is based on the current modal yield under the respective management modes. The second model compares farmer income at a uniform yield level of 2,428 kgs/ha (600 kg/fedan) of wheat. The latter model reveals how differences in mode of financing affects farm incomes. Income estimates are made for the total farm (i.e. 5 ha holding consisting of three parcels of about 1.7 ha each). This is the predominant farm allotment in the White Nile pump schemes.

Table 6. Net returns per hectare for wheat crop by management modes, 1993-1994

	Units	Parastatal managed	Private Company managed	Farmer Organization managed
Yield/hectare	Kgs	893	833	714
Sale Price	$/kg	0.165	0.165	0.165
Gross Returns	$	147	137	118
Production Costs				
Seed	$	22	22	22
Fertilizer	$	28	37	20
Chemicals/Spraying	$	12	25	12
Sacks**	$	3	2.6	26
Land Preparation	$	10	12.3	9.5
Desilting Irrigation Canals	$	1.6	2	1.4
Harvesting	$	10	16	14
Hired Labor	$	5	2.2	6
Other Costs	$	4	0	2
Administration Charges				
Harvesting Fee	$	0	0	1.4
Land and Water	$	8.4	8.4	8.4
Management Charges	$	1.6	3	2
Total Costs	$	105	130	100
Net Returns	$	42	7	18

* modal yields ** bags for collecting/storing harvest

Exchange rate = 1US$ = 425 LS.

Source: Survey data and scheme management records.

The cropping pattern is a three course rotation: wheat - sorghum -fallow. A majority of farms in all schemes cultivate the entire wheat parcel and grow sorghum on about half the extent. The remaining area is left fallow. Wheat is the principal irrigated crop. Sorghum is the staple food crop and is grown mainly under rainfed conditions with some supplementary irrigation. Annex Table 3 gives the cost and returns per hectare of sorghum in the White Nile pump schemes during 1994. Due to the unavailability of information on the costs and returns for sorghum in the schemes selected for study, figures given in Annex Table 3 were taken as the standard in the crop budget for all three management modes.

Income estimates also take into account the value of farm products consumed at home[15] and the following taxes are levied: a) Zakat[16]; b) Uhur[17]; c) Gibana[18]; and d) crop tax[19].

Farm incomes in farmer managed schemes

Under the Islamic banking system, the bank provides material inputs in kind under the *murabaha*[20] system and cash to pay for services as *salam* credit. The cash requirements and the value of each credit component is given in Annex Table 4. Although the loans are interest free, there is a "service charge" of 3 percent per month on the *murabaha* credit. The *salam* component entails the forward sale of the crop at prices determined prior to the growing season. The cash equivalents of servicing these loans are set out in Annex Table 5.

Details of the cash incomes of farmers in the farmer managed scheme are given in Annex Table 6. For Model 1, at the current yield levels, the farmer incurs a net loss of some $130 (LS55,600) after loan repayment, tax obligations and allowing for on-farm consumption (Annex Table 6). In Model 2, which assumes a wheat yield of 1,428kgs/ha, the farmer realizes a net cash surplus of about $25 (LS10,000) from the holding. It is noteworthy that taxes and cost of servicing loans represent a substantial drain on the farmers' potential cash earnings amounting to some 30 percent of the gross earnings from agriculture. This has far reaching implications on the financial sustainability of farmer management of agricultural production in the White Nile pump schemes.

Farm incomes in company managed schemes

Annex Table 7 sets out the total farm budget for the company managed schemes. As noted earlier the company finances the entire cultivation of the wheat crop and recovers the cost in kind after harvest. The profit is then divided on the basis of 54 percent to the tenant, 42 percent to the company and 4 percent is set a side for "social development." All taxes for the wheat crop are paid by the company. It is assumed that farmers pay only the Zakat tax on Sorghum. Under the terms of the contract farmers are required to surrender the entire wheat crop to the company. Therefore, the computation of the value of produce consumed is confined only to sorghum.

Estimates presented in Annex Table 7 show that farmers in the company managed schemes incur a cash deficit of $34 at the current yield of 833 kgs/hectare of wheat. The deficit is substantially lower than in the farmer managed schemes as the company pays the taxes and other government dues. At the assumed wheat yield of 1,428 kg/ha the cash surplus of farmers in the company managed schemes is about twice the surplus realized in the farmer managed schemes.

The company's share of the profit amounts to $5 from a 1.7 ha. wheat holding before taxation at the current yield level of 833 kgs/ha. This represents a return of about 2 percent on its investment[21]. At the production level of 1,428 kg/ha (model 2) the company realizes a pre-tax profit of about $74 from a 1.7 ha. wheat holding. This gives a return of about 33% on its investment.

Farm incomes in parastatal managed schemes

The budgeted incomes of farmers in the schemes provisionally retained under parastatal administration is given in Annex Table 8. Although at the present level of production the net cash benefit of farmers is negative, the deficit is less than in the schemes transferred to the private company or brought under farmer management. This is because of the lower cost of production and higher yields recorded in the parastatal schemes.

Hence, under the present system of institutional credit and the prevailing agricultural tax system in Sudan, farmers are financially better off under parastatal management than private sector management.

Is farmer management of irrigation schemes financially sustainable ?

The focus so far has been on the implications of state disengagement from the management of agricultural production in the White Nile pump schemes. At present the state retains the ownership of pumps and is in charge of their operation and maintenance. The Government of Sudan is contemplating the outright transfer of ownership and the operation and maintenance of the irrigation facilities to farmer organizations and private companies.[22] A key question is whether farmers have the financial capacity to take charge of operation and maintenance of the irrigation facilities - given the prevailing high tax structure, the high cost of credit and the fact that the production and marketing of cotton and wheat (the dominant crops in the White Nile schemes) continue to be state regulated. A misjudgment of this issue will have far reaching consequences for the White Nile pump schemes in particular and the country's economy in general.

The prospects for farmer take over of irrigation facilities should be judged in terms of their ability to pay the fuel cost for operating the diesel pumps and operation and maintenance costs of other irrigation facilities. Based on information obtained from the White Nile Agricultural Scheme Administration, Narayanamurthy (1995) estimates that the cost of diesel consumed ranged from US cents 0.35 (LS1.49) to US cents 0.43 cents (LS1.85) per m3 for pumps with engine capacities of 85-406 HP. An estimate made by IFAD sets the figure at US cents 0.14/m3 (LS 0.6/m3). Narayanamurthy (ibid) estimated the fuel cost for supplying 8,579 m3 of water per hectare for the wheat crop at three cost rates - US cents 0.19, 0. 28 and 0.38/m3 (0.8, 1.2, 1.6 LS/m3 respectively).

Table 7 gives the estimated fuel cost for irrigating a hectare of wheat. Operation and maintenance costs excluding the cost of fuel are about $31/ha (LS13,200). Total O&M cost/ha ranges from $48 (LS20,200) to $64 (LS26,300) for the different fuel cost rates specified (Table 7). It is evident from the net cash income estimates given in Annex Tables 6 to 8 that farmers would not be able to pay for the fuel leave alone bear other O&M costs at their current income levels. Unless there is a reduction in taxes and costs of production, and measures are taken to increase wheat yields, transferring O&M responsibilities will not be financially sustainable.

Table 7. Cost of supplying water and O&M charges - wheat crop

Costs	Fuel Cost Rates		
	US cents 0.19 (LS 0.8)	US cents 0. 28 (LS 1.2)	US cents 0. 36 (LS 1.6)
Fuel Costs f or Pumping 8570 m3/Hectare of Water	US $ 17	US $ 24	US $ 31
O&M Charges/hectare (excluding fuel cost)	US $ 31	US $ 31	US $ 31
Total Cost of Water Supply & O& M/ hectare	US $ 48	US $ 55	US $ 62
Total Cost of Water Supply & O& M/ 1.7 ha parcel	US $ 82	US $ 94	US $ 105

Source: Narayanamurthy [1995]
Exchange rate: 1 US$ = 425 LS

This analysis has been only on the transferred schemes engaged in wheat production. It will be worthwhile analyzing the prospects for farmer take over of the White Nile pump schemes in the event of a shift to cotton cultivation or to other alternative crops.

Conclusion

The evidence presented in this chapter suggests that in Sudan, irrigation management transfer is premature. The country's economy is in disarray. Precariously low official reserves, hyperinflation, shortages of production inputs, spare parts and fuel, escalating costs of agricultural inputs and a crumbling infrastructure characterize the economy. Production of wheat and cotton continue to be regulated by the state. Production remains oriented towards a state dominated economy. Political patronage is a key factor in private sector participation in the irrigation management transfer program. As a result the pioneering attempt to privatize the White Nile pump schemes as been administratively chaotic.

Under these circumstances it is hardly surprising that, contrary to government's expectations, the private sector has been unenthusiastic about the privatization of the White Nile schemes. Four years after the reforms were initiated, only one company had taken over management of few schemes. 33 schemes are provisionally managed by farmer organizations and some 90 schemes have been abandoned.

High taxation and the high cost of borrowing impose a substantial financial burden on farmers. As the analysis shows, farmers growing wheat experience a negative cash balance at current levels of production, once tax obligations and debt service are met. Even if wheat yields double, the cash surplus from their farms is barely sufficient to pay the cost for fuel for operating the pumps, let alone financing other operation and management tasks.[23]

The lesson which emerges from this study is that unplanned and abrupt withdrawal of state management can be counter-productive. Merely changing the ownership or the mode of management of an irrigation system does not necessarily result in improved performance. Far more important is the economic, political and the institutional environment within which it functions. To create a more dynamic irrigated agricultural sector, governments must be committed to comprehensive macro-economic and sectoral policy reforms aimed to provide the conditions necessary to foster competition, create market conditions, strengthen management capacities of farmers and prepare them in advance to face the new situation. Unless these conditions are satisfied, management reform per se may cause more harm than benefit.

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END NOTES

[1] Irrigation is not a "stand alone" activity. It requires a reliable and economical supply of inputs (fertilizer, seeds etc.) and services (egs: markets) to realize its full potential and induce investments in irrigation (Seckler, 1989).

[2] The term "support services" refers to the procurement and distribution of seeds, fertilizer, chemicals, machinery and equipment, and services such as land preparation, credit and marketing.

[3] The functions of the Agricultural Corporations were to: i) specify the area allocated to various crops, ii) procure and supply agricultural inputs to farmers, iii) supply machinery and equipment and carry out tasks such as land preparation, aerial spraying,, harvesting, iv) determine planting dates, irrigation schedule and the dates of other cultivation practices, v) pay cash advances to farmers, vi) procurement of cotton and wheat produced and recover the cost of inputs and services rendered, and vii) recover land and water charges from farmers.

[4] The area under cotton - the principal irrigated crop - declined from 331,795 hectares in 1981/82 to 281,526 hectares in 1989/90. Total cotton output dropped from 5.8 metric tons in 1983 to 2.3 metric tons in 1990. Yields of irrigated cotton, wheat, sorghum and groundnuts were only a quarter to a third of the potential yields (World Bank, 1990).

[5] WNASA had an accumulated debt of about US$ 2 million by 1990 (Records of Advisory Unit for Agricultural Corporations, Ministry of Agriculture). Many schemes under its management were dilapidated and under-performing for several years resulting in a high incidence of indebtedness amongst farmers.

[6] Although recent estimates are unavailable, the indications are that it has substantially exceeded this figure during the last few years.

[7] Total external debt was estimated at US$ 16 billion in 1992, which was over US$ 600 per capita (nearly twice the annual GDP).

[8] IFAD (1993).

[9] The leading edge of this economic regime is the Islamic banking system which was introduced with the establishment of the Faisal Islamic Bank in 1978. This system found political expression with certain influential religious groupings which gave them a greater political significance than its voting constituency would warrant (Duffield, 1990).

[10] Appendix I gives a brief account of salient characteristics of the six schemes and outlines the sampling method for the farm survey.

[11] Narayanamurthy (1995).

[12] Two of the companies which had opted out were Green Valley Pastures Ltd and Zaituna,both located in Kosti.

[13] See Annex Table 2 for method of deriving the weighted average.

[14] Hydraulic Research Station, Wad Madani (personal communication).

[15] According to a study done in a major White Nile province, per capita coarse grain consumption was estimated at 0.5 kg/day (information obtained from the IFAD project office in Kosti). The average household size is 6.1 persons/household (IFAD, ibid) . On this basis the annual coarse grain requirement per household was estimated to be about 1,300 kg. Assuming that 80% of grain consumption is sorghum and 20% wheat, the consumption needs were set at 10 bags (1000 kgs) of sorghum and 3 bags (300 kgs.) of wheat. These amounts are accounted for in the budgets for each farm model.

[16] Zakat is a religious tax levied on cereal crops only and equivalent to 2.5% of output on any production increases of 2000 kgs. The rate actually charged at present is 5%.

[17] Uhur is a tax levied by the central government at the rate of 8% on the marketable surplus.

[18] Gibana is a local government tax currently set at 40 and 60 Sudanese Pounds for sorghum and wheat, respectively.

[19] A crop or profit tax is levied by the central government at the rate of 5%.

[20] The murabaha system is similar to the hire-purchase system. Material inputs are supplied by the Bank is kind and the farmers reimburse the cost to the Bank in kind after harvest.

[21] Analysis of the current incomes in the company managed schemes was based on accounts maintained by the private company and supplemented by information obtained from farm surveys carried out for this study. Several farmers in the company managed schemes expressed their dissatisfaction about the records maintained by the company.

[22] The transfer of irrigation facilities and ownership of land to farmers is a key component of the White Nile Agricultural Services Project currently being implemented with financial assistance from IFAD (IFAD, 1994).

[23] See Table 12

Appendix 1 Field data collection

Field Study Locations

Field studies were carried out in six randomly selected schemes: two schemes (Rawda and Guli) managed by the parastatal agency, two schemes (Tawila and Umganeem) managed by a private company and two schemes (Salati and Almagam) managed by farmer organizations. The table below gives the salient characteristics of the six selected schemes.

Characteristics	Rawda	Guli	Tawila	Umganeem	Salati	Almagam
Management mode	Parastatal agency	Parastatal agency	Private company	Private company	Farmer Organization	Farmer Organization
Location (Province)	Ed Dueim	Kosti	Kosti	Kosti	Ed Dueim	Ed Dueim
Command Area (hectares)	221	524	-	215	218	353
Area Irrigated (hectares)	171	505	170	200	76	340
Average Size of holding (ha)	5	6.3	5	5	4	5
Cropping Pattern						
Summer Crop	Sorghum	Sorghum	Sorghum	Sorghum	Sorghum	Sorghum
Winter Crop	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat

The Farmer Sample

In each of the six selected schemes, three field blocks (called a 'number': a 38 hectare block of land fed by a single water course called 'abu ishreen,' off -taking from a minor canal) were selected on the basis of the location of the 'abu ishreen at the head, middle and tail end of the minor canal. From each block a sample of nine farmers were selected: three farmers whose fields are fed by the field canal taking of from the head of the 'abu ishreen', three from a the middle and three from the tail end. Thus, the survey sample consisted of 162 farmers: 27 farmers from each scheme. Data obtained from seven farmers were excluded from the final analysis as the information was considered unreliable.

Appendix 2 *Methodology for the computation of service delivery performance index*

The computation of the Service Delivery Performance Index was based on the results of survey carried out among a sample of 155 tenants from six selected schemes: two schemes managed by the private sector, two scheme adminstered by the White Nile Agricultural Scheme Adminstration and two schemes managed by the Duiem Tenants' Management Organization.

The sample of tenants were each asked whether they were satisfied or dissatisfied with the following services provided by the management:

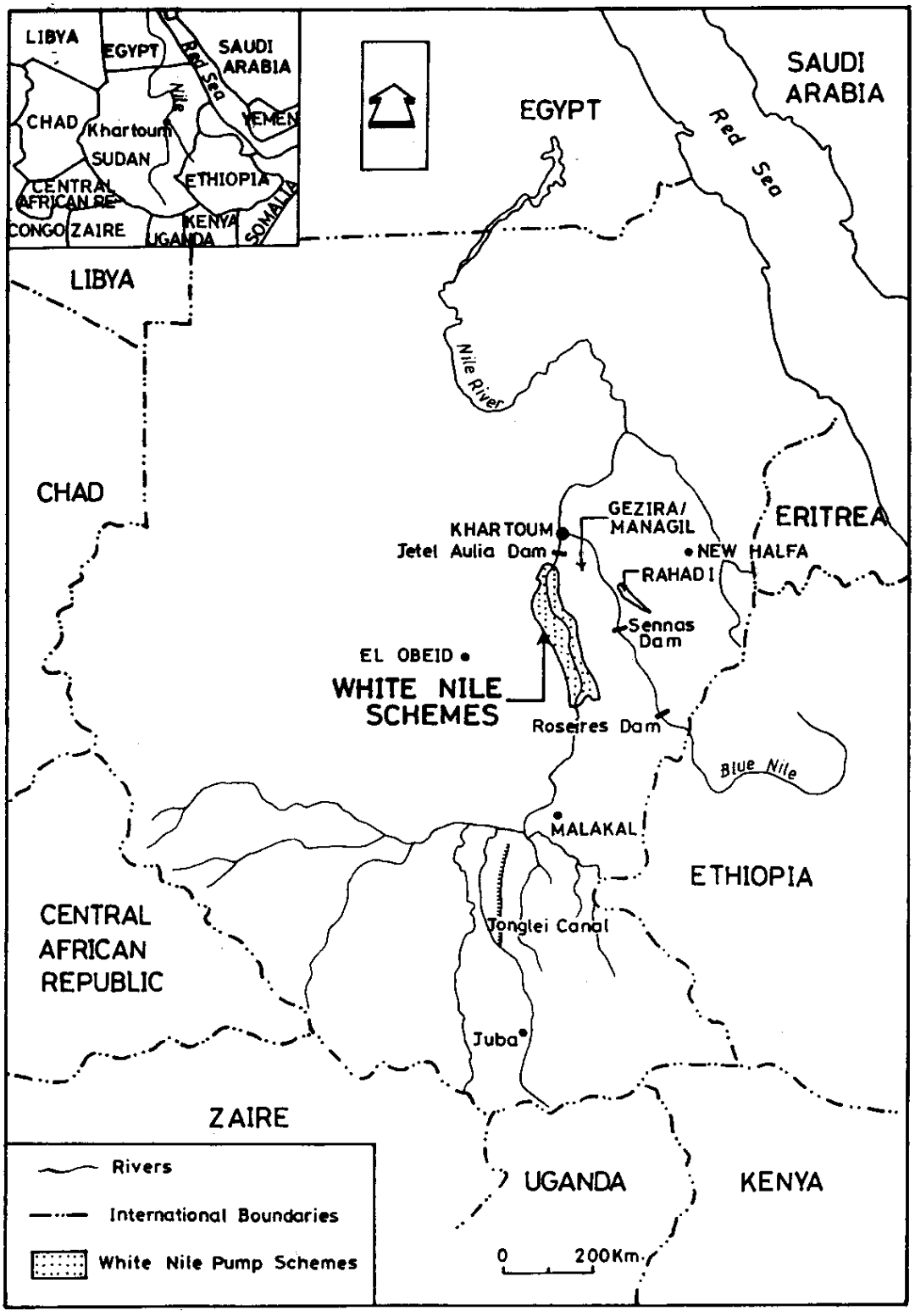
i. Timeliness of land preparation
ii. Quality of land preparation
iii. Timeliness of seed supply
iv. Timeliness of sowing
v. Timeliness of fertilizer supply
vi. Timeliness of pest and disease control.
vii. Timely provision of machinery and equipment
viii. Timeliness of harvesting the crop.

To compute the index, a score was assigned to each of the above services on the basis of the repsonses of the tenants interviewed. The criteria used was as follows:

i.	Seventy five percent or more of the tenants interviewed were satisfied with the service.	4 points
ii	Fifty to seventy four percent of the tenants satisfied	3 points
iii.	Twenty five to fifty percent of the tenants satisfied	2 points
iv.	Ten to twenty five percent of the tenants satisfied	1 point
v.	Less than ten percent of the tenants satisfied	0

Based on the foregoing score the service delivery performance index can take a value from 0 to a maximum score of 32 (8x4)

Figure 1. *Location of White Nile Pump Schemes*



Annex Table 1. Service Delivery Performance By Management Modes in Six Schemes

	Parastatal Agency		Private Company		Farmer Organization	
Service	**Rawda**	**Guli**	**Tawila**	**Umganeem**	**Salati**	**Almagam**
Timeliness of land preparation	4	4	3	0	2	2
Quality of land preparation	4	4	3	3	4	4
Timeliness of seed supply	4	4	4	2	3	2
Timeliness of sowing	4	4	4	2	1	1
Timeliness of fertilizer supply	4	4	4	1	2	2
Timeliness of pest and disease sontrol	4	4	4	2	4	4
Provision of machinery and equipment	4	4	4	3	1	1
Timeliness of harvest	1	4	4	3	3	1
TOTAL SCORE	**29**	**32**	**30**	**16**	**20**	**17**

Annex Table 2. Number of irrigations received by farmers in the three typesof schemes, wheat crop 1993-94

	Number of Farmers Reporting (%)					
Number of Irrigations	**4**	**5**	**6**	**7**	**8**	**Weighted Average***
Scheme management						
Parastatal agency	15	27	10	18	30	6.21
Private company	12	12	33	8	35	6.42
Farmer organization	20	37	28	15	0	5.38

Weighted average = $\frac{\Sigma w X_{n1\text{-}8}}{\Sigma w}$

Where w = weighting factor corresponding to % of farmers receiving the respective number of irrigations. X = number of irrigations.

Source: Study survey data

Annex Table 3. Cost and returns per hectare for Sorghum, White Nile Area, 1993/94

	Units	Value
Sorghum yield	kgs/ha	1200
Price of sorghum	$/kg	0.05
Gross revenue	$/ha	60
Production costs		
Seed	$	0.5
Fertilizer	$	15
Sacks	$	2.4
Land preparation	$	2.2
Desilting irrigation canals	$	1.5
Harvesting	$	6
Hired labor	$	10
Administration charges		
Land and water	$	7
Management charges	$	2
Total costs	$	47
Net revenue	$	13

Exchange rate : 1 US$ = 425 LS
Source: Department of Agricultural Economics and Statistics, Khartoum

Annex Table 4. Cash requirements and credit type for a 1.7 ha parcel of wheat in farmer managed schemes, 1993/94 season

Cost Item	Costs/Parcel	Credit Type	
	($)	Murabaha ($)	Salam ($)
Seeds	36	36	
Fertilizer	34	34	
Chemicals	20	20	
Sacks	4	4	
Land preparation	16		16
Desilting irrigation canals	2.4		2.4
Harvesting	24		24
Hired labor	9.5		9.5
Other costs	3		3
Administrative charges			
Harvesting fee	2.4		
Land and water	14		
Management charges	3		
TOTAL	168	94	55

Exchange rate: 1 US$ 425 LS

Annex Table 5. Cost of institutional credit, farmer managed schemes [wheat crop 1993-1994]

		Loan Type		Cost of Debt
		Murabaha	Salam	Service
1	Total value of loan ($)	94	55	
2	Service charge on Murabaha loan ($)	17		17
3	Wheat equivalent of Salam loan valued at Salam price (kgs)		658	
4	Equivalent value of Salam loan at market prices ($)		107	
5	Less Price adjustment on Salam loan ($)		36	
6	Cash equivalent of Salam loan repayment ($)		71	
7	Cost of debt service- Salam loan ($)		16	16
8	Total cost of debt service ($)			33

*Units of measurement in parenthesis. Exchange rate: 1 US$ = 425 LS

Notes on computation of cost of debt service

The notes given below relate to the corresponding row number in the table.

1. As specified in Annex Table 4
2. Estimated at the current rate of 3% per month for 6 months.
3. Total value of Salam Loan [$ 55]: Salam price of wheat $ 0.082/Kg. 4. Wheat equivalent of salam loan [658 kg.] x market price [$ 0.16/kg.]5. Adjusted value as per salam loan repayment estimates. 6. Row 4 - Row 5 7. Row 6 - Value of salam loan in Row 1

Annex Table 6 Total farm budget - 5 hectare(twelve fedan) holding - farmer organization managed scheme

	Units	MODEL 1*	MODEL 2**
1. Cropping pattern			
Wheat	Hectare	1.7	4
Sorghum	Hectare	.8	2
Fallow	Hectare	2.5	4
2. Total production			
Wheat	kgs	1214	2428
Sorghum	kgs	950	950
3. Gross value of production			
Wheat	$	194	388
Sorghum	$	50	950
4. Loan receipt		149	149
5. Total cash inflow	**$**	**393**	**587**
6. Cost of production and sdministration			
Production costs	$	179	179
Administrative charges	$	26	26
7. Taxes:			
Zakat	$	12.2	22
Uhur	$	12	28
Gibana	$	9.5	22
Crop tax	$	5	9
8. Total outflow		**244**	**287**
9. Net benefit before loan repayment		**149**	**304**
10. Loan repayment			
Value of loan		149	149
Debt fervice		35	35
Total loan repayment		183	183
11. Net benefit after taxation and loan repayment		-34	121
12. Less Value of home consumed production		-96	-96.
13. Net cash benefit		**-130**	**25**

* Model 1 = Existing cropping pattern and modal yield ** Model 2 = Assumed yield of 1428 kg/ha
Exchange rate: 1US$ = 425 LS

Notes: Notes given below relate to the corresponding row number in the table

1. Based on the current three course rotation
2. From Table 6 for wheat and Annex Table 3 for sorghum
3. Total production x market price [Wheat = $ 0.16/kg. Sorghum = $0 .05 /kg]
4. Loan facilities only for wheat = from Annex Table 4
6. Production and administrative costs for wheat [Table 6] and Sorghum [Annex Table 3]
7. Taxes computed as follows: a. Zakat = 5% of gross value of production; b. Uhur = 8% levy on marketable surplus. Marketable surplus = total production - Quantity retained for home consumption.; Model 1 takes marketable surplus as wheat = 900 kgs [9 bags], sorghum = 0; Model 2: marketable surplus of wheat = 9 bags, sorghum = 10 bags; c. Gibana = local tax on marketable surplus at the current rate of $ 1.05/bag (100 kg) of wheat and sorghum; d. Crop tax = 2% on the gross value of production

Annex Table 7. Total farm budget - 5 hectare (twelve fedan) Holding - Company Managed Scheme

		Units	MODEL 1*	MODEL 2**
1	**Cropping pattern**			
	Wheat	Ha	1.7	1.7
	Sorghum	Ha	0.8	0.8
	Fallow	Ha	2.5	2.5
2	**Wheat crop**			
	Total production	kgs	1416	2428
	Gross value of production	$	231	395
	Production costs	$	200	200
	Administrative charges	$	19	19
	Total costs	$	219	219
	Net Returns per parcel of wheat	$	12	176
3	**Tenants share of profits from wheat (54%)**	$	**6**	**95**
4	**Sorghum**			
	Total production	kgs	950	950
	Gross value of production	$	47	47
	Production costs	$	31	31
	Administrative charges	$	7	7
	Total cost	$	38	38
	Net returns from sorghum	$	9	9
5	**Net income before taxes and home consumed Production**	$	**15**	104
6	**Taxes**			
	Zakat	$	2.3	2.3
7	**Less value home consumed production**	$	-47	-47
8	**Net cash benefit**	$	**-34**	**55**

*Model 1 = Existing cropping pattern and modal yield ** Model 2 = Assumed yield of 1428/ha
Exchange rate : 1 US$ = 425 LS

Notes: Notes given below relates to the corresponding row number in the table:

1. Based on the current three course rotation
2. Wheat yields from Table 6 for Model 1. Model 2 yields based on author's survey results.
   Total production x market price of wheat [$ 0.16/kg]; Production and Administrativce Ccosts from Table 6.
3. Farmer share = 54% of profit as state in the Tenancy Contract .
4. Sorghum yield, costs and returns from Annex Table 3
5. Farmer's share of profit from wheat [row 3] net returns from sorghum.
6. It is assumed that the tenant pays the 5% Zakat tax on sorghum. All taxes on the wheat are paid by the company in accordance with the tenancy contract.
7. Only the consumption requirements for sorghum are accounted for. The farmer surrenders the wheat crop to the company.

Annex Table 8 Total farm budget - 5 hectare (twelve fedan) Holding - Parastatal Managed Scheme

		Units	MODEL 1*	MODEL 2**
1	**Cropping pattern**			
	Wheat	Ha	1.7	1.7
	Sorghum	Ha	0.8	0.8
	Fallow	Ha	2.5	2.5
2	**Total production**			
	Wheat	Kgs	1518	2428
	Sorghum	Kgs	950	950
3	**Gross value of production**			
	Wheat	$	247	395
	Sorghum	$	47	47
4	**Loan receipt**	$	159	159
5	**Total cash inflow**	**$**	**453**	**601**
6	**Cost of production**			
	Production costs	$	159	22
	Administrative charges	$	17	28
7	**Taxes:**			
	Zakat	$	15	22
	Uhur	$	16	28
	Gibana	$	13	22
	Crop Tax	$	6	9
8	**Total outflow**	$	**225**	**257**
9	**Net benefit before loan repayment**	$	**228**	**345**
10	**Total loan repayment**	$	159	159
11	**Net benefit after taxation and loan repayment**	**$**	69	**185**
12	**Less value of home consumed production**	$	- 96	-96
13	**Net cash benefit**	$	**-27**	**89**

* Model 1 = Existing Cropping Pattern and modal Yield Model 2 =Assumed yield of 1428/hectare

Exchange rate : 1 US$ = 425 LS

Notes: Notes given below relate to the corresponding number in the table.

1. Based on the current three course rotation.
2. From Table 6 for wheat and Annex Table 3 for Sorghum
3. Total production x market price [Wheat = $ 0.16 /kg,, Sorghum = $ 0.05 /kg]
4. Loan facilities only for the production cost of wheat-loan repaid in kind after harvest at the prevailing market price.
6. Production and administrative cost for wheat [Table 6] and Sorghum [AnnexTable 3]
7. Taxes computed as for Annex Table 6
10. Value of production loan repaid in kind.
11. See text.