THE DEMOCRATIC REPUBLIC OF THE SUDAN
MINISTRY OF NATIONAL PLANNING
(Project Preparation Unit)

NEW HALFA IRRIGATION PROJECT
REHABILITATION STUDIES
PHASE II
Support Measures
ANNEX 8
Economic Aspects
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AGRAR- UND HYDROTECHNIK GMBH
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The farm sizes and therefore the family income would change according to the number of tenants who actually participate in the Scheme under Project conditions and also according to the total irrigable area which is determined by the diminishing availability of irrigation water over the project areas. Assuming the participation of 70 per cent of the tenants (15,400), the family income from all agricultural enterprises (excluding the income from freehold land and sorghum outside the Scheme and deducting a farm service charge of LS 150) would reach a maximum in 1990 (the effects of the Short-Term Measures are predominant up to this year) coming to some LS 1,000 for those farmers who have adopted the improved livestock enterprises. The income would however be only about half of this at the beginning of the Project (few effects of the Short-Term Measures) and at the end of the Project lifetime (due to the effect of the reducing cropping area per tenancy; this effect is predominant from 1990 onwards) (see Table 32).

Two effects in the labour demand/supply situation can be expected from the Project:

- hired labour would be shifted to family labour
- the total labour demand of cotton and groundnuts would decrease.

The shift would be caused by the improved livestock component because the cattle will be kept near the houses and it can be expected therefore that the greater part of the work will be performed by the family. The labour demand per feddan of cotton and groundnut production would decrease at weeding time due to the introduction of mechanical inter-row cultivation. In groundnut harvesting in particular, a reduction of labour demand would appear due to mechanical picking and stripping. About 9,200 seasonal labourers from outside the Scheme would be necessary in 1986 (largest extension of the cropping area) in December and about 6,200 in January for cotton picking. It can be regarded as possible to collect this number of labourers from outside the Scheme for cotton harvesting because higher picking wages would be paid and the efficiency per labourer would be higher (higher yields), thus promising higher income for the labourers than at present.

1. Present Situation

1.1 Introduction

In the Phase I Study the then prevailing agro-economic situation was analyzed in most aspects in sufficient detail.

As however the situation has changed substantially since 1978, the analysis presented in the Phase I Study has to be up-dated in order to reflect the reality of the present agro-economic situation.

The up-dated Phase I analysis has been amended by more detailed investigations, e.g. the Scheme's labour demand/supply situation. This had been specifically requested in the Terms of References of the Phase II Study.

The up-dated and amended analysis as presented in the following chapters has to be seen in context with the Phase I Study, as pure repetitions of that Study have been omitted.

1.2 Areas Cultivated and Yields

As a good indication of the trends in the Scheme, the cropped areas and the average yields of the Scheme should be looked at (Table 1).

Cotton as the most important export crop for the country shows a rapid decrease in harvested area over the last two years. The cultivated area has in recent years been at least 10,000 feddans larger than the harvested area. The difference between cultivated and harvested area is land which was given up during the production season. This fact and the decreasing harvested area indicate clearly that the tenants are less and less interested in cultivating the crop satisfactorily, but perform only some stages in growing cotton in order to receive the cash advances from the Corporation. This is underlined by the declining average yields in recent years.

The same trend can be seen with the wheat crop. The reasons for this might be twofold. Wheat is traditionally not the staple food for the tenants of nomadic origin (2/3 of the tenant population). Taking the low profitability of this crop in the Scheme into consideration it is understandable that this section of the population tends not to grow wheat any more and prefers to grow their staple food sorghum outside or - illegally inside the Scheme. The Halfawyeen section of the population is willing to continue growing wheat (their staple food). In 1979/80 the wheat area has already nearly reached a level where it is grown only by the Halfawyeens.

The wheat price fixed by the Government was adjusted in August 1979 to the free market price level LS 111 per ton. This price was regarded as justified to use for the calculation of the present situation because only very small quantities of wheat still enter the free market. Together with the value of the sacks, the price comes to LS 115.8 per ton.

Sorghum prices in New Halfa are higher than in other areas of the Sudan because the Scheme is at present a net importing area. In February 1980 a farmers' market price of LS 71.9 per ton was ascertained in New Halfa. Adding the value of the sacks of LS 5.39, the farmers' market price used here amounts to LS 77.3.

The farmgate prices (farmers market price less transport to the market less the value of the sacks) have changed since the Project preparation of Phase I as follows:

	Phase I Study	Phase II Study	Increase
Groundnuts	LS 63.3 per ton	LS 90.2 per ton	42 per cent
Wheat	LS 67.2 per ton	LS 108.6 per ton	62 per cent
Sorghum	--	LS 69.5 per ton	--

1.6 Crop Budgets and Productivity Analysis

The crop budgets of cotton, groundnut, wheat and sorghum are shown in Tables 6 to 9. Groundnut is the most profitable crop with an enterprise profit of LS 69.5 per hawasha, followed by sorghum with LS 27.5 per hawasha and wheat with LS 15.7 per hawasha. The enterprise profit of cotton has been ascertained at LS -47.9 per hawasha.

If the income drawn from family labour in the corresponding crop is added to the enterprise profit, the above sequence does not change: groundnuts has a family income of LS 146.6 per hawasha, then sorghum with LS 73.5 per hawasha, wheat LS 29.8 per hawasha and finally cotton with LS -3.1 per hawasha.

Discussions with farmers concerning the cotton Joint Account syste suggested that they do not expect revenues from cotton sales because very often the cotton accounts are burdened with debts accumulated from previous years. Together with the debts of the concerning Year the balances of the cotton accounts are often negative, thus the debts are not paid back. This results in a situation where the tenants only regard cash advances for the performance of various operations and the advance for delivering the seed cotton to the collection centre as "revenues" from cotton Consequently, they balance these "revenues" against their own production costs that they incur for hired labour, material and

transport costs. The family income calculated in this way is still negative, amounting to LS - 1.5 per hawasha (see Table 6). Bearing these figures in mind, it is logical that the farmers grow cotton only under the Corporation's compulsion and then mainly to receive the cash advances and to have some area to graze their cattle in the dry season.

Due to changes in costs, yields and prices, the enterprise profits of the Phase I Study have also changed:

	Phase I Study	Phase II Study
Cotton	LS -7.2/hawasha	LS -47.9/hawasha
Groundnuts	LS 76.4/hawasha	LS 69.5/hawasha
Wheat	LS -7.0/hawasha	LS 15.7/hawasha
Sorghum	---	LS 27.4/hawasha

The drastic increase in the loss per hawasha for cotton is caused by the decrease in yield of about 17 per cent (see Chapter 1.2) and higher costs per hawasha in relation to yields, as a result of the method of calculating the Joint Account. The profitability of groundnuts was lower during Project preparation than in the Phase I Study, due to the substantial increase in costs. This overshadows the effects of higher yields and prices. In the case of wheat, the price, which is at present substantially higher, leads to a higher enterprise profit, although yields are slightly lower and costs increased.

The productivity analysis in Table 10 includes all enterprises presently performed in the Scheme. It leads to the following sequence of the relative superiority concerning the utilization of labour, which is the production factor in most limited supply in the Scheme at farm level:

- sorghum: LS 2.10 per man/day
- groundnuts: LS 2.08 per man/day
- wheat: LS 1.77 per man/day
- cotton: LS 0.71 per man/day
- cattle: LS 0.53 per man/day
- sheep: LS 0.38 per man/day
- goats: LS 0.35 per man/day.

As can be seen from Table 10 sorghum and groundnuts are very close together. This means that if calculations are based on slightly different data, then the sequence of the two crops might be reversed as well.

The productivity analysis indicates a further reason to those established in the profitability analysis as to why the tenants prefer to grow sorghum and groundnuts rather than wheat and cotton.

The labour demand for the livestock in the Scheme, once it has been equally distributed over the year, has been added to that for crop production. This total labour requirement has to be met by three types of labour force:

- the family labour force of the tenant families
- the migrant labour force living permanently in the Scheme
- and the migrant labour force entering the Scheme only seasonally.

The available family labour of the tenants has been calculated under the assumption that only 20 per cent of the tenant population works in agricultural enterprises, another 30 per cent of this section of the population works in off-farm employment, and the rest is regarded as too young for working. Those tenants who are actually employed in agriculture work for 20 days a month. In the case of the migrant labour force living permanently in the Scheme, it has been assumed that 50 per cent of them work in agriculture for 25 days a month.

Comparing the calculated supply of tenant family labour for agriculture with the calculated demand for family labour in the Scheme, a large pool of unutilized labour appears. In all months with the exception of December, more than 50 per cent of the available family labour is not employed.

A different picture is drawn in the hired labour sector. In 6 months the supply of the labourers who live permanently in the Scheme is exceeded. The resulting short-fall has to be met by labourers from outside the Scheme who enter the Scheme only seasonally. Thus the following numbers of seasonal migrant labourers are necessary in order to keep the production on the present level: January: 760, February 3,320, March 1,400, September 2,080, October 520, December 6,160.

2. Effects of the Short-Term Measures

2.1 Areas Cultivated and Expected Yields

The size of irrigated area is determined by the availability of irrigation water (see ANNEX 1). This led to the proposal to abolish the dry season wheat crop , which is irrigated exclusively by stored water, and thus obtain larger groundnut and cotton areas.

As a third crop, sorghum would be introduced into the Scheme as a rainfed corn crop as well as a fodder crop. Thus the sorghum area is only limited by the number of tenants expected to participate in the Scheme. In the first five years, sorghum could occupy an area similar to that occupied by groundnuts(1). I the following five years it has been assumed that the sorghum area would increase to 90,000 feddans and then remain constant. In order to determine the grain sorghum area, the fodder sorghum area necessary to meet the Livestock Programme has been deducted for every year.

The main agricultural improvement would be the double ridge system which would be introduced during a 5 year period. In the first year, 20 per cent of the cropped area (excluding fodder sorghum) would be cultivated with the double ridge system, in the second year 40 per cent, and 60, 80 and 100 per cent in the following years. With the new cultivating system, the yields would increase from 650 to 1,100 kg per feddan in the case of cotton, and from 900 to 2,000 kg per feddan in the case of groundnuts, during a 25 year period. The yields of rainfed grain sorghum would increase to 400 kg per feddan. No double ridging is foreseen for sorghum (see ANNEX 2 and ANNEX 10). A constant yield of 5 tons fodder is expected with fodder sorghum.

Due to the phased introduction of double ridging, and hence the phased increases in yields, the average yields of the Scheme had to be calculated for every year (cotton and groundnuts). The areas cultivated, the production and the yields are shown in Table 22.

2.2 Relationship between the Tenants and the Corporation

2.2.1 Costs and Revenues of Cotton

The reorganization of the relationship between the Corporation and the tenants concerning the costs and revenues of cotton is the most important and most critical point of all measures in the Scheme.

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1) It cannot be expected that the sorghum area would increase in the first four years of the Project to reach the same size as the groundnut area. Thus in year five only the total sorghum area would occupy

to the modifications proposed in ANNEX 7, Chapter 5.1.4, be adopted. According to this, a credit and service contract would be signed every year by the Corporation and each tenant. The agreement would only be signed by the Corporation for the next season if all debts of the previous years are recovered. The costs for machinery services and materials would be charged to that crop which had caused them. The overhead costs would be recovered by a farm service charge.

It has been assumed that the farm service charge would amount to LS 150 per tenant per annum if all 22,000 tenants are taken into account. Due to the lack of information to the contrary, overhead costs per tenant are assumed to remain constant. This means that the amount of the farm service charge would remain constant for less tenants than 22,000.

2.3 Costs of Production

The costs of cotton, groundnuts, grain sorghum and fodder sorghum are shown in Tables 23 to 26 on a feddan basis. This unit has been preferred to the hawasha (5 feddans), because the cropped area per farmer will change in future every year according to the decreasing availability of water and the number of tenants who have to share the irrigable area. In this respect the feddan has been considered a more practical unit than the hawasha.

The detailed calculations of machinery costs can be found in ANNEX 3. Under Project conditions they would be substantially higher for cotton and groundnuts than in the present situation. This is mainly caused by more machinery-intensive cultivation practices and higher machinery costs per hour (for details see ANNEX 3).

With cotton and groundnuts, inter-row cultivation would be introduced in order to reduce the high labour demand for weeding. The groundnuts would be lifted by hand but picked and stripped by machine. This results in higher machinery costs but lower labour costs.

The wage rate has been determined at LS 1 per man/day following the IBRD (1) assumptions. The wages for cotton picking have been doubled from LS 0.005 per lb picked to LS 0.01 per lb. This incentive is regarded to be necessary in order to attract enough labour to perform this work.

The picking costs in cotton, the harvesting costs of grain sorghum and the cleaning costs of groundnuts are related to the yields. With increasing yields, these costs will also increase.

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1) IBRD: Staff Appraisal Report, New Halfa Irrigation Rehabilitation Project, Sudan. Report No. 2608a-SU. April 24, 19
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In the following cost comparison between the present situation and the Project conditions, the change which would occur in production costs over 25 years are shown.

Farmgate production costs (1) of:	Present situation	Project conditions
Cotton	LS 53.2 per feddan (2)	LS 87.7 - 100.6 per fedd
Groundnuts	LS 46.2 per feddan	LS 56 - 58 per fedd
Wheat	LS 27.3 per feddan	---
Grain Sorghum	LS 13.8 per feddan	LS 14.6 per fedd

The production costs of one feddan of fodder would amount to LS 22.7. Assuming a production of 5 tons per feddan, the cost of production for one ton of fodder would be LS 4.5. In order to calculate the family income from livestock (see Volume II), the production costs excluding the family labour costs have been used. They would amount to LS 2.9 per ton.

2.4 Value of Production

In this Report a Project lifetime of 30 years has been considered. In order to value the prices of the production, farmgate prices have been chosen which are representative for the Project's lifetime. Farmgate prices 1990 in 1980 constant prices have been found appropriate (for details see ANNEX 18).

All changes in farmgate prices as shown below are caused by the world market price projection, with the exception of sorghum. The sorghum price in the Scheme has been found higher than the world market price level during Project preparation, due to the specific situation of the area in and around the Scheme. This area is at present a net importer of sorghum. Under Project conditions this situation would change and would adjust the prices in the Scheme area to the world market price level.

Farmgate price of (1)	Present situation	Project conditions
Cotton	LS 94.8 per ton (2)	LS 286.2 per ton
Groundnuts	LS 90.2 per ton	LS 89.5 per ton
Wheat	LS 108.6 per ton	---
Grain sorghum	LS 69.5 per ton	LS 62.9 per ton

1) Excluding costs of sacks and transport costs of harvest to market.

2) This figure cannot be compared with the figure under Project conditions because the costs of the present situation are determined by the Joint Account system.

2.5 Crop Budgets and Productivity Analysis

The expected change of the crop budgets has been projected over 25 years in Tables 27 to 29 for cotton, groundnuts and grain sorghum. The costs of fodder production are included in the livestock components (see Volume II).

Cotton appears as the most profitable crop in every year of the lifetime of the Project. Groundnuts are less profitable in the first Project year than in the present situation, due to the lower farmgate prices. But they reach a high profitability at the end of the Project period. As a result of the decrease in the farmgate price and higher production costs, the enterprise profit of sorghum is lower in the first Project year than in the situation found during Project preparation.

Enterprise profit of:	Present situation	Project conditions
Cotton	LS -9.6 per feddan	LS 64.6 - 213.1 per fedda
Groundnuts	LS 13.9 per feddan	LS 9.2 - 121 per fedda
Wheat	LS 3.1 per feddan	---
Grain sorghum	LS 5.5 per feddan	LS 1o.6 per fedda

In Table 30, the productivity of labour is analyzed for all enterprises of the Project. It is expressed as farm income per man/day. The figures would lead in the first Project year to the following sequence of relative superiority:

Cotton:	LS 3.3 per man/day
Grain sorghum:	LS 2.5 per man/day
Groundnuts:	LS 1.5 per man/day
Livestock type 1 (full herd development):	LS 1.5 per man/day
Livestock type 2 equal with Livestock type 3 (full herd development):	LS o.8 per man/day

In 2000 the sequence would change to:

Groundnuts:	LS 6.3 per man/day
Cotton	LS 5.9 per man/day
Grain sorghum:	LS 2.5 per man/day
Livestock type 1 (full herd development):	LS 1.2 per man/day
Livestock type 2 equal with Livestock type 3 (full herd development):	LS o.8 per man/day

The same sequence would be found in 2005. The livestock components have been included in this analysis only with full herd development. Taking into consideration that some years would be necessary to arrive at this stage which entails lower productivity figures in the first years (see also Volume II), the second sequence is considered to be more appropriate for showing the situation under Project conditions. According to these findings groundnuts and cotton would be favoured above all other enter-

prises taking into consideration the labour productivity only.

Considering solely cotton and groundnuts, it is noticeable that during the first 10 years labour productivity for cotton would be better than in the case of groundnuts. Around 1990, this situation would be reversed.

2.6 Farm Budget

Farm sizes would change according to the number of tenants who actually participate in the Scheme under Project conditions, and according to the total irrigable area. The area is determined by the diminishing availability of irrigation water over the Project years (see also ANNEXES 1 and 2). The number of participating tenants depends on the amount of income which can be drawn from agricultural enterprises in the Scheme as well as on social aspects like the attitude to agricultural work and on alternative occupation possibilities. Two extreme cases are therefore considered:

- All 22,000 tenants participate in the Scheme over the whole lifetime of the Project for example due to the lack of alternative occupations. They would do so regardless of the amounts of money they can earn in the agricultural enterprises of the Scheme.
- The participation of the tenants is solely determined by income from the tenancy. LS 700 from crop production during Project preparation was established as a figure for the farmers which would satisfy their expectations.

For the first case the acreage per tenancy of each crop is shown in Table 31. The gross family income (before deduction of the farm service charge; see Chapter 2.2.3) would be determined by two directly opposed effects:

- The decreasing area per tenancy would have the effect of lowering the gross income from crop production.
- The Project measures have the effect of increasing the income.

The second effect would dominate in the first ten years, later the first effect would be stronger. Thus the gross family income from crop production amounts to LS 260 per tenancy in 1981 increasing then to LS 580 in 1990 and decreasing again to LS 300 in year 2005.

Assuming the second extreme case it would be a condition for the participating tenants to earn a net family income of LS 700 leads to the opposite question: how many farmers could participate under this condition.

In order to receive a net family income of LS 700 per tenancy, LS 850 have to be drawn from crop production as gross family income, because the farm service charges of LS 150 still have to be recovered from the gross amount. The formula for calculating the number of tenants is the following:

$$\frac{a \cdot LC + b \cdot LG + c \cdot LS}{850} = \text{number of participating farmers}$$

where:

a: total number of feddan available for cotton
b: total number of feddan available for groundnuts
c: total number of feddan available for grain sorghum
LC: income per feddan cotton
LG: income per feddan groundnuts
LS: income per feddan sorghum.

Due to the same effects as mentioned for the first case the number of participating farmers would increase from 6,400 tenants in 1981 to 15,000 tenants in 1990 and then decrease again to 7,700 tenants in 2005.

The reality would be somewhere in between these two extreme cases. In the first years of the Project lifetime, nearly all 22,000 tenants can be expected to participate, due to the changes caused by the Scheme. After several years, some farmers would recognize that their income expectations cannot be satisfied and look for off-farm employment. Thus on average, about 70 per cent of the tenants can be expected to participate, i.e. 15,400 tenants (see also ANNEX 2). This number of farmers has been taken for calculating the farm budget (see Table 32).

Depending on the type of livestock enterprise a farmer would adopt, the net family income would come to around LS 1,000 in 1990 with the improved livestock enterprises, and reach LS 850 with a traditional cattle enterprise and LS 720 with a traditional sheep and goats enterprise. As can be seen in Table 32, the net family income would be much lower in the beginning of the Project and at the end of the Project lifetime.

2.7 Supply and Demand of Labour in the Scheme

The total labour requirement per feddan of the crops has been divided into family labour and hired labour. Tables 33 to 36 show the labour distribution over the year of the four crops under Project conditions.

In Table 37 the labour demand for the whole Scheme is summarized for the year 1986 as it would be after implementation of the Short-Term Measures. In this year the cotton and the groundnut area reaches its largest extent. In order to cover contingencies, a larger area of grain sorghum has been assumed than would apply for 1986 according to Table 22, because it might well be that more grain sorghum is grown by the population than foreseen in the Project. For the yield-related labour demand of cotton and sorghum, the highest yields have been assumed.

Due to the incentives and measures described in Chapter 2.2.2 a higher participation of the tenant families can be expected for agricultural enterprises. Thus 25 per cent of the tenant population would work in agriculture for 25 days a month, compared to 20 per cent of the tenant population for 20 days a month in the present situation.

The larger labour reservoir of the tenants' family labour would be mainly absorbed by the livestock components. As can be seen in Table 38 the calculated family labour force is much more utilized than at present, but the demand in no month exceeds the theoretical supply.

The supply of hired labour from those labourers who live in the Scheme permanently has been assumed to remain the same as in the present situation. About 6,200 seasonal labourers from outside the Scheme would be necessary to cover the labour demand in January and 9,200 in December. This is about 3,000 labourers more than in the present peak demand period. But it can be assumed that there would be no difficulty in finding these labourers in Gedaref and Kassala due to higher picking wages (see Chapter 2.3) (the peak demand in December and January is mainly caused by cotton harvest) and because the higher yields mean that the labourer can pick more cotton per man/day.

ANNEX 8
Table 3

Individual Joint Account Expenditures in 1978/79

Item	Expenditures for productive area in LS	Expenditures for total cultivated area in LS
Land preparation	329,587	390,161
Ridging	83,324	98,638
Heavy weed control	65,379	77,395
Rat control	5,350	6,333
Cotton seed	44,984	53,252
Fertilizer (urea)	865,500	1,024,570
Aerial spraying	1,639,289	1,940,573
Cotton sacks	97,132	97,132
Picking payment	432,475	432,475
Cash advance for pulling stalks and sweeping	315,571	315,571
Collection centre expenses	51,115	51,115
Transport collection centre to ginnery	100,434	100,434
Total	4,030,140	4,587,649

Source: NHAPC.

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Table 4

Individual Tenant Account Expenditures in 1978/79

Item	Expenditures for productive area in LS	Expenditures for total cultivated area in LS
Cash advances for sowing, resowing, thinning, 1.-4. weeding	952,608	1,127,686
Direct labour costs (1)	74,645	88,364
Machinery costs for Abu Sita and dividing into basins	113,078	133,861
Machinery costs for green ridging	30,947	36,635
Cleaning Abu Ishreen	40,755	48,245
Cash advances for collecting labourers	42,031	42,031
Corporations' costs for collecting labourers	39,526	39,526
Cash advances for shed of pickers	54,972	54,972
Total	1,348,561	1,571,320

Source: NHAPC.

1) If a tenant refused to perform one of the operations, the Corporation spent money on hired labourers to do this work.

Crop Budget: Present Situation - Groundnuts
LS per Hawasha

Item	Total costs (LS)	Machinery costs (LS)	Transport, material and financial costs (LS)	Labour costs Man-day	Labour costs (LS)	Family labour %	Family labour (LS)
A. Operation							
1. Land preparation							
1.1 Land clearance	3.00	-		2	3.00	40	1.20
1.2 Disc harrowing	5.00	5.00(1)		-	-	-	-
1.3 Ridging	7.50	7.50		-	-	-	-
Sub-total	15.50	12.50		2	3.00		1.20
2. Crop management							
2.1 Sowing	9.00	-		6	9.00	55	4.95
2.2 First weeding	25.00	-		15	25.00	42	10.50
2.3 Second weeding	15.00	-		18	15.00	42	6.30
2.4 Third weeding	6.00	-		8	6.00	48	2.88
2.5 Green ridging	5.00	5.00		-	-	-	-
Sub-total	60.00	5.00		47	55.00		24.63
3. Maintenance							
3.1 Abu Ishreen	3.00	1.00		1	2.00	42	0.84
3.2 Abu Sita	1.75	0.75		1	1.00	48	0.48
3.3 Dividing into basins (Gadwal)	1.50	-		1.5	1.50	55	0.83
3.4 Tagnat Harbi	0.60	0.35		0.25	0.25	55	0.14
Sub-total	6.85	2.10		3.75	4.75		2.29
4. Irrigation							
4.1 Pre-watering	1.00	-		1	1.00	45	0.45
4.2 First watering	1.50	-		1	1.50	38	0.57
4.3 Subsequent watering	5.00	-		5	5.00	45	2.25
Sub-total	7.50	-		7	7.50		3.27
5. Harvest							
5.1 Lifting	45.00	-		28	45.00	48	21.60
5.2 Heaping	15.00	-		10	15.00	48	7.20
5.3 Stripping (2)	47.50	27.50		8	20.00	48	9.60
5.4 Cleaning by water	6.00	-		3	6.00	55	3.30
Sub-total	113.50	27.50		49	86.00		41.70
6. Transport (8)							
6.1 Seed to field	0.60	-	0.60				
6.2 Harvest to market	8.00	-	8.00				
Sub-total	8.60	-	8.60				
Sub-total A	211.95	47.10	8.60	108.75	156.25		73.09
B. Materials							
7. Seeds (3)	25.01		25.01				
8. Sacks (4)	35.89		35.89				
Sub-total B	60.90		60.90				
C. Financial costs							
9. Interest (5)	2.00		2.00				
Total costs	274.85	47.10	71.50		156.25		

Yields : 666 kg/feddan (6), i.e. 3.33 tons per hawasha
Value of yields : 103.42 per ton (7): LS 344.39
Enterprise profit : 69.54

Source: Own investigations and calculations, NHAPC.

1) Only about 50 per cent of the tenants are doing it, i.e. 50 per cent of the costs per hawasha have been taken
2) Approximately 50 per cent of the tenants are doing this operation by hand, the other by machine, i.e. 50 per cent of the costs of each possibility have been included.
3) Mainly used own seed kept from the previous year - market price is valid. Seed rate is 254 kg.
4) 74 sacks à LS 0.485.
5) The tenant gets cash credit LS 75 to grow groundnuts,
for planting and 1st weeding LS 30,
2nd and 3rd weeding LS 30,
harvesting LS 15.
He has to repay LS 83 after the season. About 25 per cent of the farmers are using this possibility.
6) 5 years average.
7) Average price in the market LS 4.92 per sack (45 kg) with the sack (LS 0.485), less 5 per cent local tax, less LS 0.02 social services, equals LS 4.654; LS 103.42 per ton.
8) LS 0.08 per ton km; average distance 30 km.

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Table 8

Crop Budget: Present Situation - Wheat
LS per Hawasha

Item	Total costs (LS)	Machinery costs (LS)	Transport, material and financial costs (LS)	Labour costs Man-day	Labour costs (LS)	Family labour %	Family labour (LS)
A. Operation							
1. Land preparation							
1.1 Land clearance	6.00	-		4	6.00	42	2.52
1.2 Disc harrowing (1)	5.00	5.00		-	-	-	-
1.3 Ridging (2)	2.25	2.25		-	-	-	-
Sub-total	13.25	7.25		4	6.00		2.52
2. Crop management							
2.1 Sowing	7.50	7.50		-	-	-	-
2.2 Weeding	10.00	-		10	10.00	50	5.00
2.3 Fertilizer application	0.50	-		0.5	0.50	48	0.24
2.4 Aerial spraying	4.00	4.00		-	-	-	-
Sub-total	22.00	11.50		10.05	10.50		5.24
3. Maintenance							
3.1 Abu Ishreen	3.00	1.00		1	2.00	47	0.94
3.2 Abu Sita	1.75	0.75		1	1.00	57	0.57
3.3 Dividing into basins (Gadwal)	1.50	-		1.5	1.50	60	0.90
3.4 Tagnat Harbi	0.60	0.35		0.25	0.25	60	0.15
Sub-total	6.85	2.10		3.75	4.25		2.56
4. Irrigation							
4.1 Pre-watering (3)	0.50	-		0.5	0.50	57	0.29
4.2 First watering	1.50	-		1	1.50	47	0.71
4.3 Subsequent watering (5)	5.00	-		5	5.00	57	2.85
Sub-total	7.00	-		6.5	7.00		3.85
5. Harvest	25.00	25.00		-	-		
6. Transport (10)							
6.1 Fertilizer to fields	0.60		0.60	-	-		
6.2 Seed to fields	0.60		0.60	-	-		
6.3 Harvest to market	3.36		3.36	-	-		
Sub-total	4.56		4.56	-	-		
Sub-total A	78.66	45.85	4.56	24.75	28.25		14.17
B. Materials							
7. Fertilizer (4)	31.65		31.65				
8. Seeds (5)	27.75		27.75				
9. Sacks (6)	6.79		6.79				
Sub-total	66.19		66.19				
10. Taxes (7)	1.68		1.68				
Total costs	146.53	45.85	72.43		28.25		

Yields : 280 kg/feddan (8), i.e. 1.40 tons per hawasha
Value of yields : LS 115.85 per ton (9): LS 162.19
Enterprise profit : LS 15.66

Source: Own investigations and calculations, NHAPC.

1) Only 50 per cent of the farmers are doing it, i.e. 50 per cent of the costs per hawasha have been taken.
2) Only about 30 per cent are doing it, i.e. 30 per cent of the costs per hawasha have been taken.
3) Only 50 per cent of the farmers are doing it, i.e. 50 per cent of the costs per hawasha have been taken.
4) 5 bags à LS 6.33 per bag.
5) 250 kg à LS 11.10 per bag (à 100 kg).
6) 14 sacks à LS 0.485.
7) 10 sacks are tax-free. For the excess yield the farmer has to pay LS 0.42 per sack.
8) 5 year average.
9) The government fixed price is LS 111.0 per ton. Together with the sack it comes to LS 115.85 per ton.
10) LS 0.08 per ton km; average distance 30 km.

ANNEX 8
Table 9

Crop Budget: Present Situation - Grain Sorghum
LS per Hawasha

Item	Total costs (LS)	Machinery costs (LS)	Transport, material and financial costs (LS)	Labour costs Man-day	Labour costs (LS)	Family labour %	Family labour (LS)
A. Operation							
1. Land preparation							
1.1 Land clearance	4.50	-		1.5(1)	4.50(1)	80	3.60
1.2 Disc harrowing	7.50	7.50(1)		-	-	-	-
1.3 Ridging	3.75	3.75(2)		-	-	-	-
Sub-total	15.75	11.25		1.5	4.50		3.60
2. Crop management							
2.1 Sowing	6.00	-		4	6.00	90	5.40
2.2 Weeding	15.00	-		10	15.00	70	10.50
Sub-total	21.00	-		14	21.00		15.90
3. Maintenance							
3.1 Abu Ishreen	1.50	0.50(3)		0.5(3)	1.00(3)	80	0.80
3.2 Abu Sita	0.70	0.30(4)		0.4(4)	0.40(4)	80	0.32
3.3 Dividing into basins (Gadwal)	-	-		-	-	-	-
3.4 Tagnat Harbi	0.50	-		0.5	0.50	80	0.40
Sub-total	2.70	0.80		0.7	1.90		1.52
4. Irrigation							
4.1 Pre-watering	-	-		-	-	-	-
4.2 First watering	1.50	-		1	1.50	100	1.50
4.3 Subsequent waterings (2x)	2.00	-		2	2.00	100	2.00
Sub-total	3.50	-		3	3.50		3.50
5. Harvest							
5.1 Harvest	12.00	-		12	12.00	90	10.80
5.2 Threshing	12.00	-		8	12.00	90	10.80
Sub-total	24.00	-		20	24.00		21.60
6. Transport (7)							
6.1 Seed to field	0.07	-	0.07	-	-	-	-
6.2 Harvest to market	3.24	-	3.24	-	-	-	-
Sub-total	3.31	-	3.31	-	-		-
Sub-total A	70.26	12.05	3.31	39.20	54.90		46.12
B. Materials							
7. Seeds (5)	1.94	-	1.94				
8. Sacks	4.85	-	4.85				
Sub-total B	6.79	-	6.79				
Total costs	77.05	12.05	10.10		54.90		

Yields : 270 kg/feddan, i.e. 1,350 kg/hawasha
Value of yield : LS 77.3 (6) per ton: LS 104.4
Enterprise profit : LS 27.35

Source: Own investigations and calculations, NHAPC.

1) Only about 75 per cent are doing it, i.e. 75 per cent of the costs per hawasha have been taken.
2) Only 50 per cent are doing it, i.e. 50 per cent of the costs per hawasha have been taken.
3) Only 50 per cent are doing it, i.e. 50 per cent of the costs per hawasha have been taken.
4) Only 40 per cent are doing it, i.e. 40 per cent of the costs per hawasha have been taken.
5) 27 kg kept from their own harvest - market price of the farmer of LS 71.9 per ton.
6) LS 71.9 per ton plus LS 5.39 for sacks equals LS 77.3 per ton.
7) LS 0.08 per ton km; average distance 30 km.

ANNEX 8
Table 10

Productivity Analysis (Present Situation)

	Cotton	Wheat	Groundnuts	Sorghum	Cattle (1)	Sheep (1)	Goats (1)
	per hawasha				per herd		
Labour requirements in man-days per year	123.75	24.75	108.75	39.2	286.5	277.4	156.35
Farm income (LS)	88.26	43.91	225.79	82.25	153.19	104.50	54.29
Productivity (LS/man-day)	0.71	1.77	2.08	2.10	0.53	0.38	0.35

Source: Own calculations, Tables 6, 7, 8, 9.

1) Assuming that the labour requirements for livestock are equally distributed over the year.

ANNEX 8
Table 13 Contribution of Family Labour to Total Labour Demand - Cotton

Operations	Halfawyeen (%)	Nomads (%)	Average of all tenants (1) (%)
Land clearance	15	30	25
Sowing	10	50	37
Thinning	0	5	3
1. Weeding	0	35	23
2. Weeding	0	50	33
3. Weeding	0	60	40
Fertilizer application	5	35	25
Maintenance Abu Ishreen	5	50	35
Maintenance Abu Sita	5	55	38
Tagnat Harbi + Gadwal	40	65	57
Pre-watering	5	60	40
First watering	5	55	38
Subsequent waterings	5	45	32
Shade for pickers	0	60	40
Picking, sacking	0	60	40
Pulling stalks	0	60	40
Sweeping	0	60	40

Source: Own estimations.

1) Halfawyeens 1/3 of the tenants, Nomads 2/3 of the tenants.

ANNEX 8 Contribution of Family Labour to Total Labour Demand - Groundnuts
Table 14

Operation	Halfawyeens (%)	Nomads (%)	Average of all tenants(1) (%)
Land clearance	0	60	40
Sowing	5	80	55
1. Weeding	5	60	42
2. Weeding	5	60	43
3. Weeding	5	70	48
Maintenance Abu Ishreen	5	60	42
Maintenance Abu Sita	5	70	48
Tagnat Harbi + Gadwal	5	80	55
Pre-watering	5	65	45
First watering	5	55	38
Subsequent waterings	5	65	45
Lifting	5	70	48
Heapening	5	70	48
Stripping	5	70	48
Cleaning by water	5	80	55

Source: Own estimations.

1) Halfawyeen 1/3 of the tenants, Nomads 2/3 of the tenants.

ANNEX 8
Table 15 Contribution of Family Labour to Total Labour Demand - Wheat

Operations	Halfawyeen (%)	Nomads (%)	Average of all tenants (1) (%)
Land clearance	5	60	42
Weeding	50	50	50
Fertilizer appl.	45	50	48
Maintenance Abu Ishreen	40	50	47
Maintenance Abu Sita	50	60	57
Tagnat Harbi + Gadwal	60	60	60
Pre-watering	70	50	57
1. watering	60	40	47
Subsequent waterings	70	50	57

Source: Own investigations.

1) Halfawyeens 1/3 of the tenants; Nomads 2/3 of the tenants.

ANNEX 8
Table 16

Contribution of Family Labour to Total Labour Demand
Sorghum

Operations	% (1)
Land clearance	80
Sowing	90
Weeding	70
Maintenance Abu Ishreen	80
Maintenance Abu Sita	80
Tagnant Harbi + Gadwal	80
1. watering	100
Subsequent waterings	100
Harvest	90

Source: Own estimations.

1) Only Nomads are growing sorghum.

ANNEX 8
Table 19

Labour Requirement of Wheat in Man-days
(Present Situation)
Area: 1 Hawasha = 5 Feddan

Operation	Sept		Oct		Nov		Dec		Jan		Feb		March		Total	
	HL(1)	FL(2)	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL
Land clearance	0.77	0.56	1.55	1.12											2.32	1.68
Maintenance Abu Ishreen			0.53	0.47											0.53	0.47
Maintenance Abu Sita			0.43	0.57											0.43	0.57
Tagnat Harbi + Gadwal			0.70	1.05											0.7	1.05
Pre-watering			0.14	0.19	0.07	0.09									0.21	0.28
Sowing			-	-	-	-									-	-
First watering					0.36	0.31	0.18	0.16							0.54	0.47
Fertilizer appl.					0.17	0.16	0.09	0.08							0.26	0.24
Weeding							4.00	4.00	1.00	1.00					5.00	5.00
5 waterings							0.65	0.86	0.65	0.86	0.65	0.86	0.22	0.29	2.17	2.87
Total	0.77	0.56	3.35	3.40	0.60	0.56	4.92	5.10	1.65	1.86	0.65	0.86	0.22	0.29	12.16	12.63

Source: Own estimations and investigations, NHAPC, Tables 8. 15.

1) Hired labour.
2) Family labour.

ANNEX 8
Table 20

Labour Requirement of Sorghum in Man-days
(Present Situation)
Area: 1 Hawasha = 5 Feddans

Operation	May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total	
	HL(1)	FL(2)	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL
Land clearance	0.15	0.60	0.15	0.60													0.30	1.20
Maintenance Abu Ishreen			0.10	0.40													0.10	0.40
Maintenance Abu Sita			0.08	0.32													0.08	0.32
Tagnat Harbi + Gadwal			0.10	0.40													0.10	0.40
Sowing			0.08	0.72	0.32	2.88											0.40	3.60
First watering					-	1.00											-	1.00
Weeding					0.75	1.75	1.50	3.50	0.75	1.75							3.00	7.00
Second watering									-	0.50	-	0.50					-	1.00
Third watering											-	1.00					-	1.00
Harvest													1.20	10.80			1.20	10.80
Threshing													0.40	3.60	0.40	3.60	0.80	7.20
Total	0.15	0.60	0.51	2.44	1.07	5.63	1.50	3.50	0.75	2.25	-	1.50	1.60	14.40	0.40	3.60	5.98	33.92

Source: Own estimations and investigations, NHAPC, Tables 9, 16.

1) Hired labour.
2) Family labour.

Monthly Labour Demand of the New Halfa Scheme - Present Situation
('000 Man-days)

	February		March		April		May		June		July		August		September		October		November		December		Total	
(2)	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL	HL	FL
1	186	112	149	98	78	52	82	54	39	29	35	24	22	12	78	24	78	29	87	45	47	28	975	558
7	8	10					7	5	21	20	68	61	75	54	83	64	25	23	7	6	184	169	506	439
4	5	7	2	2											6	4	26	26	5	4	38	40	95	97
							0	1	1	4	2	9	2	5	1	3	-	2	2	22	1	5	9	51
2	199	129	151	100	78	52	89	60	61	53	105	94	99	71	168	95	129	80	101	77	270	242	1,585	1,145
4	390	224	390	224	390	224	390	224	390	224	390	224	390	224	390	224	390	224	390	224	390	224	4,680	2,688
6	589	353	541	324	468	276	479	284	451	277	495	318	489	295	558	319	519	304	491	301	660	466	6,265	3,833
3	506	763	506	763	506	763	506	763	506	763	506	763	506	763	506	763	506	763	506	763	506	763	6,072	9,156
7	-83	410	-35	439	-38	487	27	479	55	466	11	445	17	468	-52	444	-13	459	15	462	- 154	297	- 193	5,323

bles 1, 17, 18, 19, 20, ANNEX 4 (labour availability).

nants: 3,529,680 man-days; 87% of herding and 42% of milking is hired labour:	2,959,944 HL	569,736 FL
nts with 19 sheep each: 1,640,544 man-days; 80% hired labour:	1,312,440 HL	328,104 FL
nts with 4 sheep each: 423,984 man-days; 40% hired labour;	169,596 HL	254,388 FL
nts with 10.5 goats each: 1,232,940 man-days; 20% of herding and king is hired labour:	241,872 HL	991,068 FL
nts with 5 goats each: 540,528 man-days; 0% hired labour:	-	540,528 FL
	4,683,852 HL	2,683,824 FL : 12 = 390,321 HL 223,652 FL

f tenant families; 20% work in agriculture enterprises, 20 days a month: 763,180 man-days.
f permanent migrant labour families; 50% work in agricultural enterprises, 25 days a month: 506,437 man-days.

Projected Areas and Yields - Short-Term Measures (Reduced Water Supply)

Cotton		Groundnuts			Grain Sorghum			Fodder Sorghum		
Total area feddan	Average yields kg/feddan	Total production tons	Total area feddan	Average yields kg/feddan	Total production tons	Total area feddan	Average yields kg/feddan	Total production tons	Total area feddan	Average yields tons/feddan
58,472	532	41,527	57,029	728	6,345	15,862	400	128,325	25,665	5
57,373	610	45,987	55,531	828	5,947	14,867	400	144,375	28,875	5
58,345	634	50,213	56,316	892	5,910	14,774	400	166,825	33,365	5
59,989	687	54,820	57,737	949	7,062	17,654	400	179,325	35,865	5
62,465	720	59,888	59,938	999	8,201	20,503	400	196,925	39,385	5
63,080	753	62,644	59,941	1,045	8,998	22,495	400	217,075	43,415	5
62,350	786	63,980	58,644	1,091	9,391	23,478	400	242,275	48,455	5
60,679	816	64,126	56,330	1,138	9,570	23,925	400	270,150	54,030	5
57,969	843	62,666	52,814	1,187	11,652	29,130	400	274,240	54,848	5
55,003	865	61,920	49,309	1,256	12,736	31,840	400	290,800	58,160	5
52,054	888	59,082	45,823	1,289	12,482	31,205	400	293,975	58,795	5
49,110	910	57,019	42,344	1,347	12,136	30,340	400	298,300	59,660	5
46,181	932	54,938	38,882	1,413	11,808	29,520	400	302,400	60,480	5
43,267	955	52,533	35,439	1,482	11,646	29,115	400	304,425	60,885	5
40,383	977	49,615	32,031	1,549	11,488	28,720	400	306,400	61,280	5
37,523	997	46,082	28,650	1,608	11,372	28,430	400	307,850	61,570	5
34,644	1,011	41,870	25,248	1,658	11,372	28,430	400	307,850	61,570	5
33,394	1,021	41,402	23,770	1,742	11,372	28,430	400	307,850	61,570	5
31,946	1,032	38,441	22,059	1,743	11,372	28,430	400	307,850	61,570	5
30,467	1,042	36,248	20,312	1,785	11,372	28,430	400	307,850	61,570	5
29,023	1,053	33,991	18,606	1,827	11,372	28,430	400	307,850	61,570	5
27,038	1,064	30,418	16,260	1,871	11,372	28,430	400	307,850	61,570	5
25,066	1,075	26,686	13,929	1,916	11,372	28,430	400	307,850	61,570	5
23,118	1,085	22,787	11,626	1,960	11,372	28,430	400	307,850	61,570	5
21,138	1,096	18,574	9,287	2,000	11,372	28,430	400	307.850	61,570	5
19,181	1,100	13,946	6,973	2,000	11,372	28,430	400	307,850	61,570	5
17,225	1,100	9,326	4,663	2,000	11,372	28,430	400	307,850	61,570	5
15,144	1,100	4,406	2,203	2,000	11,372	28,430	400	307,850	61,570	5
12,202	1,100	-	-	2,000	11,372	28,430	400	307,850	61,570	5
7,635	1,100	-	-	2,000	11,372	28,430	400	307,850	61,570	5

lations, ANNEX 1, 2, Volume II.

ANNEX 8
Table 43

Production Costs: Short-Term Measures - Cotton
(LS per Feddan)

Item	Total costs (LS)	Machinery costs: Hours/feddan	Machinery costs: LS/hour	Machinery costs: Total LS	Transport, material and financial costs	Labour costs: Man-days/feddan	Labour costs: LS/man-day	Labour costs: Total/LS	Family labour: %	Family labour: LS
A. Operations										
1. Land preparation										
1.1 Disc ploughing	5.38	0.39	13.66	5.38		-	-	-	-	-
1.2 Harrowing 2x	5.64	0.42	13.44	5.64		-	-	-	-	-
1.3 Double ridging	3.05	0.22	13.87	3.05		-	-	-	-	-
Sub-total	14.07	1.03		14.07		-	-	-	-	-
2. Crop management										
2.1 Sowing	4.40	0.55	8.00	4.40		-	-	-	-	-
2.2 Interrow cultivation 4x	5.34	0.66	8.09	5.34		-	-	-	-	-
2.3 Weeding 4x	4.50	-	-	-		4.5	1.00	4.50	32(1)	1.44
2.4 Fertilizer application	0.20	-	-	-		0.2	1.00	0.20	25	0.05
2.5 Aerial spraying	19.16	-	-	19.16		-	-	-	-	-
Sub-total	33.60	1.21		28.90		4.7		4.70		1.49
3. Maintenance										
3.1 Abu Ishreen (13)	0.14	0.01	13.96	0.14		-	-	-	-	-
3.2 Abu Sita	0.28	0.02	13.96	0.28		-	-	-	-	-
Sub-total	0.42	0.03		0.42						
4. Irrigation										
4.1 10 waterings	4.00	-	-	-		4(2)	1.00	4.00	32	1.28
5. Harvest										
5.1 Shade for pickers	0.25	-	-	-	-	0.25	1.00	0.25	40	0.10
5.2 Collecting labourers	1.00	-	-	-	1.00(3)	-	-	-	-	-
5.3 Picking (4)	13.00	-	-	-	-	14.8	-	13.00(5)	40	5.20
5.4 Sacking (4)	0.50	-	-	-	-	0.5	1.00	0.50	40	0.20
5.5 Pulling stalks	2.50	-	-	-	-	2.5	1.00	2.50	40	1.00
Sub-total	17.25	-	-	-	1.00	18.05		16.25		6.50
6. Transport (6)										
6.1 Fertilizer; block centre to fields (7)	0.19				0.19					
6.2 Seeds; block centre to fields (8)	0.04				0.04					
6.3 Empty sacks to fields	0.04				0.04					
Sub-total	0.27				0.27					
Sub-total A	69.61	2.27		43.39	1.27	26.75		24.95		9.27
B. Materials										
7. Seeds (9)	1.98				1.98					
8. Fertilizers (10)	10.13				10.13					
9. Material for sheds (pickers)	0.90				0.90					
10. Food for pickers	1.00				1.00					
Sub-total B	14.01				14.01					
C. Financial costs										
11. Interest (11)	4.12				4.12					
Total costs (12)	87.74			43.39	19.40			24.95		

Source: Own calculations; ANNEXES 2, 3, Table 6.

1) Average participation in the 4 weedings.
2) 0.4 man-days per watering.
3) The Corporation collects labourers in Kassala and Gedaref. The expenses for this have to be paid back from the farmers. Presently LS 2.31 are spent on this item for 5 feddans. With the Short-Term Measures higher expenditures can be expected in order to meet the higher demand of cotton pickers in the Scheme. Thus LS 2.50 per 5 feddans have been estimated, i.e. LS 0.50 per feddan. Additionally, the farmers have to pay transport costs of LS 0.50 per labourer (1 labourer per feddan).
4) The costs of this item are related to the yields (see crop budget). The figures shown in this table represent the costs and labour requirements of the Year 1981.
5) LS 1.25 per labourer - 1 per feddan - to come to the farm plus LS 0.01 per lb. cotton picked.
6) LS 0.08 per ton km; 30 km average distance.
7) 80 kg per feddan.
8) Seed rate of 18 kg per feddan.
9) Seed rate: 18 kg per feddan. Seed is provided from the Corporation by LS 110 per ton.
10) LS 126.6 per ton ex store; 80 kg/feddan.
11) Interest on all machinery costs plus on LS 0.50 of item 5.2 and on cash advances (assuming that about 60 per cent of total labour costs are paid as cash advances). Interest rate: 7 per cent per annum; it is assumed that the credit is paid back after 12 months.
12) These figures represent the costs resulting from the labour demands for the Year 1981 (see crop budget).
13) The main portion of these costs are part of the overhead costs (farm service charge).

Production Costs: Short-Term Measures - Groundnuts
(LS per Feddan)

	Total costs (LS)	Machinery costs			Transport, material and financial costs LS	Labour costs			Family labour	
		Hours/feddan	LS/hour	Total LS		Man-day/feddan	LS/man-day	Total LS	%	LS
on										
ghing	5.38	0.39	13.66	5.38						
2x	5.64	0.42	13.44	5.64		-	-	-	-	-
ging	3.05	0.22	13.87	3.05		-	-	-	-	-
						-	-	-	-	-
	14.07	1.03		14.07		-	-	-	-	-
	5.40	0.55	8.00	4.40						
ultivation 3x	3.96	0.49	8.09	3.96		1(1)	1.00	1.00	55	0.55
	2.50	-	-	-		-	-	-	-	-
						2.5	1.00	2.50	44(2)	1.10
	11.86	1.04		8.36		3.5		3.50		1.65
n (8)	0.14	0.01	13.98	0.14						
	0.28	0.02	13.98	0.28		-	-	-	-	-
						-	-	-	-	-
	0.42	0.03		0.42		-	-	-	-	-
s	3.20	-	-	-		3.2	1.00	3.20	45	1.44
hand	8.50	-	-	-						
d stripping (mech.)	8.49	0.45	16.65	7.49		8.5	1.00	8.50	48	4.08
water (7)	1.20	-	-	-		1	1.00	1.00	55	0.55
						1.2	1.00	1.20	55	0.66
	18.19	0.45		7.49		10.7		10.70		5.29
	0.12				0.12					
	47.86	2.55		30.34	0.12	17.4		17.40		8.92
	5.48				5.48					
	2.69				2.69					
	56.03			30.34	8.29			17.40		

ons, ANNEXES 2, 3, Table 7.

for seed preparation (decortication).
rticipation for 3 weedings.
r ton km; 30 km average distance.
feddan seed rate.
Farmgate price equals LS 89.50 per ton groundnuts (unshelled) (1990) plus 20 per cent for seed preparation: LS 107.4 per ton.
n all machinery costs plus on cash advances (50 per cent of total labour costs are assumed). Interest rate: 7 per cent per annum; it is
at credit is paid back after 12 months.

Production Costs: Short-Term Measures - Sorghum (Grain)
(LS per Feddan)

	Total costs (LS)	Machinery costs			Transport, material and financial costs LS	Labour costs			Family labour	
		Hours/feddan	LS/hour	Total LS		Man-day/feddan	LS/man-day	Total LS	%	LS
	2.82	0.21	13.44	2.82		-	-	-	-	-
	4.27	0.37	11.53	4.27		-	-	-	-	-
	2.00	-	-	-		2	1.00	2.00	70	1.40
	6.27	0.37		4.27		2		2.00		1.40
lecting	3.60	-	-	-		3.6	1.00	3.60	75	2.70
	1.60	-	-	-		1.6	1.00	1.60	75	1.20
	5.20	-	-	-		5.2		5.20		3.90
	0.01				0.01					
	14.30	0.58		7.09	0.01	7.2		7.20		5.30
	0.34				0.34					
	14.64			7.09	0.35			7.20		

, ANNEXES 2, 3, Table 8.

4 kg/feddan; price: LS 62.9 per ton (farmgate).

Production Costs: Short-Term Measures - Sorghum/Legume (Fodder)
(LS per Feddan)

	Total costs (LS)	Machinery costs			Transport, material and financial costs LS	Labour costs			Family labour	
		Hours/feddan	LS/hour	Total LS		Man-days/feddan	LS/man-day	Total LS	%	LS
on										
owing	2.82	0.21	13.44	2.82		-	-	-	-	-
t										
x	4.26	0.37	11.53	4.26		-	-	-	-	-
	2.00	-	-	-		2	1.00	2.00	75	1.50
	6.26	0.37		4.26		2		2.00		1.50
nd collecting	8.80					8.8	1.00	8.80	75	6.60
ields (2)	0.01				0.01					
cattle (3)	3.20				3.20					
	3.21				3.21					
	21.09	0.58		7.08	3.21	10.8		10.80		8.10
	1.62				1.62					
	22.71			7.08	4.83					
(LS) (3)	4.54							10.80		

ions, ANNEXES 2, 3, Table 9.
er ton km; 8 km average distance.
er feddan.
dder.
farmgate price of grain sorghum (1990): LS 62.9 per ton; price of legume seed: LS 80 per ton.
: 5.40 kg sorghum and 16 kg legume.

ANNEX 8
Table 27

Crop Budgets: Short-Term Measures - Cotton
(per Feddan)

I t e m	1981	1985	1990	1995	2000	2005
Revenues						
- Yields (kg/feddan)	532	720	865	977	1,042	1,096
- Value of production (LS/ton)	286.2	286.2	286.2	286.2	286.2	286.2
Total revenues (LS/feddan)	152.3	206.1	247.6	279.6	298.2	313.7
Costs (in LS)						
- Costs related to area	74.2	74.2	74.2	74.2	74.2	74.2
- Picking costs (1)	13.0	17.1	20.3	22.8	24.2	25.4
- Sacking costs (2)	0.5	0.6	0.8	0.8	0.9	1.0
Total costs (LS/feddan)	87.7	91.9	95.3	97.8	99.3	100.6
Enterprise profit (LS)	64.6	114.2	152.3	181.8	198.9	213.1
Family labour income (LS) (3)	9.3	11.7	12.3	13.3	13.9	14.5
Gross family income (LS)	73.9	125.2	164.6	195.1	212.8	227.6
Total labour demand (man-days/feddan):						
- Labour demand related to area	11.5	11.5	11.5	11.5	11.5	11.5
- Labour demand picking (4)	14.8	20.0	24	27.1	28.9	30.4
- Labour demand sacking (5)	0.5	0.6	0.8	0.9	0.9	1.0
Total labour demand	26.8	32.1	36.3	39.5	41.3	42.9
Family labour (man-days/feddan):						
- Family labour related to area	3.9	3.9	3.9	3.9	3.9	3.9
- Family labour picking (6)	5.9	8.0	9.6	10.8	11.6	12.2
- Family labour sacking (6)	0.2	0.2	0.3	0.4	0.4	0.4
Total family labour	10.0	12.1	13.8	15.1	15.9	16.5
Hired labour demand (man-days/feddan)	16.8	20.0	22.5	24.4	25.4	26.4

Source: Own calculations, ANNEX 2, Table 23.

1) LS 0.01 per lb. picked plus LS 1.25 per feddan fixed costs to make the labourers ready to come to the farm.
2) LS 1 per man-day.

ANNEX 8
Table 27

Crop Budgets: Short-Term Measures - Cotton
(per Feddan)

I t e m	1981	1985	1990	1995	2000	2005
Revenues						
- Yields (kg/feddan)	532	720	865	977	1,042	1,096
- Value of production (LS/ton)	286.2	286.2	286.2	286.2	286.2	286.2
Total revenues (LS/feddan)	152.3	206.1	247.6	279.6	298.2	313.7
Costs (in LS)						
- Costs related to area	74.2	74.2	74.2	74.2	74.2	74.2
- Picking costs (1)	13.0	17.1	20.3	22.8	24.2	25.4
- Sacking costs (2)	0.5	0.6	0.8	0.8	0.9	1.0
Total costs (LS/feddan)	87.7	91.9	95.3	97.8	99.3	100.6
Enterprise profit (LS)	64.6	114.2	152.3	181.8	198.9	213.1
Family labour income (LS) (3)	9.3	11.7	12.3	13.3	13.9	14.5
Gross family income (LS)	73.9	125.2	164.6	195.1	212.8	227.6
Total labour demand (man-days/feddan):						
- Labour demand related to area	11.5	11.5	11.5	11.5	11.5	11.5
- Labour demand picking (4)	14.8	20.0	24	27.1	28.9	30.4
- Labour demand sacking (5)	0.5	0.6	0.8	0.9	0.9	1.0
Total labour demand	26.8	32.1	36.3	39.5	41.3	42.9
Family labour (man-days/feddan):						
- Family labour related to area	3.9	3.9	3.9	3.9	3.9	3.9
- Family labour picking (6)	5.9	8.0	9.6	10.8	11.6	12.2
- Family labour sacking (6)	0.2	0.2	0.3	0.4	0.4	0.4
Total family labour	10.0	12.1	13.8	15.1	15.9	16.5
Hired labour demand (man-days/feddan)	16.8	20.0	22.5	24.4	25.4	26.4

Source: Own calculations, ANNEX 2, Table 23.

1) LS 0.01 per lb. picked plus LS 1.25 per feddan fixed costs to make the labourers ready to come to the farm.
2) LS 1 per man-day.
3) Family labour in man-days multiplied by LS 1 per man-day. Picking costs are calculated like footnote 1 indicates (40 per cent family labour income).
4) In an average 4.5 kg cotton are picked per hour; 8 hours working day.
5) Efficiency of one man: 1 big kantar (141.75 kg) per hour; 8 hours working day.
6) 40 per cent of total labour demand is performed by family labour force

ANNEX 8
Table 28

Crop Budgets: Short-Term Measures - Groundnuts
(per Feddan)

I t e m	1981	1985	1990	1995	2000	2005
Revenues:						
- Yields (kg/feddan)	728	999	1,256	1,549	1,785	2,000
- Value of production (LS/ton)	89.5	89.5	89.5	89.5	89.5	89.5
Total revenues (LS)	65.2	89.4	112.4	138.6	159.8	179.0
Costs (LS):						
- Costs related to area	54.8	54.8	54.8	54.8	54.8	54.8
- Washing costs of yields (1)	1.2	1.6	2.0	2.5	2.9	3.2
Total costs	56.0	56.4	56.8	57.3	57.7	58.0
Enterprise profit (LS)	9.2	33.0	55.6	81.3	102.1	121.0
Family labour income (LS) (1)	8.4	8.6	8.8	9.1	9.3	9.5
Gross family income (LS)	17.6	41.6	64.4	90.4	111.4	130.5
Total labour demand (man-days)						
- Labour demand related to area	16.2	16.2	16.2	16.2	16.2	16.2
- Labour demand washing of yields	1.2	1.6	2.0	2.5	2.9	3.2
Total labour demand	17.4	17.8	18.2	18.7	19.1	19.4
Family labour (man-days)						
- Family labour related to area	7.7	7.7	7.7	7.7	7.7	7.7
- Family labour washing of yields	0.7	0.9	1.1	1.4	1.6	1.8
Total family labour	8.4	8.6	8.8	9.1	9.3	9.5
Hired labour demand (man-days)	9.0	9.2	9.4	9.6	9.8	9.9

Source: Own calculations; ANNEX 2, Table 24.

1) Labour demand in man-days multiplied by LS 1 per man-day.

ANNEX 8
Table 31

Gross Family Income from Crop Production - Short-Term Measures (Reduced Water Supply)

Year	Cotton (1)			Groundnuts (1)			Grain sorghum (1)			Gross family income(crops) (1) LS	No. of tenants (2)
	LS/feddan	No. of feddan	Income LS	LS/feddan	No. of feddan	Income LS	LS/feddan	No. of feddan	Income LS		
1981	73.9	2.7	199.5	17.6	2.6	45.7	15.9	0.7	11.1	260	6,400
1985	125.2	2.8	350.6	41.6	2.7	112.3	15.9	0.9	14.3	480	12,500
1990	164.6	2.5	411.5	64.4	2.2	141.7	15.9	1.4	22.3	580	15,000
1995	195.1	1.8	351.2	90.4	1.5	135.6	15.9	1.3	20.7	510	13,300
2000	212.8	1.4	297.9	111.4	0.9	100.3	15.9	1.3	20.7	420	10,900
2005	227.6	1.0	227.6	130.5	0.4	52.2	15.9	1.3	20.7	300	7,700

Source: Own calculations, Tables 27, 28, 29, ANNEX 2, Volume II.

1) Assuming that a total number of 22,000 tenants intend to participate from Year 1981 up to Year 2005.
2) No. of tenants, who can participate in the Scheme, if each wants to earn a net family income of LS 700, i.e. the gross family income has to come to LS 850 (farm service charge: LS 150).

Farm Budget - Short-Term Measures (Reduced Water Supply)
(15,400 Tenants)

Year	Cotton			Groundnuts			Grain sorghum			Gross income from crop production LS	Income from livestock LS(3)					Farm service charge LS	Net family income LS(1)				
	LS/ feddan	No. of feddan	Income LS	LS/ feddan	No. of feddan	Income LS	LS/ feddan	No. of feddan	Income LS		Tradi- tional with cattle	Tradi- tional without cattle	Type 1 (2)	Type 2 (2)	Type 3 (2)		Tradi- tional with cattle	Tradi- tional without cattle	Type 1	Type 2	Type 3
1981	73.9	3.8	280.8	17.6	3.7	65.1	15.9	1.3	20.9	360	177	45	310	288	326	150	390	260	520	500	540
1985	125.2	4.1	513.3	41.6	3.9	162.2	15.9	1.3	20.7	700	177	45	310	288	326	150	720	590	860	840	880
1990	164.6	3.6	592.6	64.4	3.2	206.1	15.9	2.1	33.4	830	177	45	310	288	326	150	850	720	990	970	1,010
1995	195.1	2.6	507.3	90.4	2.1	189.8	15.9	1.9	30.2	730	177	45	310	288	326	150	760	630	890	870	910
2000	212.8	2.0	425.6	111.4	1.3	144.8	15.9	1.8	28.6	600	177	45	310	288	326	150	620	490	760	740	780
2005	227.6	1.4	318.6	130.5	0.6	78.3	15.9	1.8	28.6	430	177	45	310	288	326	150	460	330	590	570	610

Source: Own calculations, Tables 27, 28, 29, Volume II, ANNEX 2.

1) Excluding off-farm income, income from freehold land and dura fields outside the Scheme.
2) Including LS 69 from sheep and goats.
3) The average income from each livestock enterprise over the Project lifetime has been taken.

ANNEX 8
Table 36

Labour Requirement - Short-Term Measures
(Reduced Water Supply) Sorghum/Legume (Fodder)
(Man-days per Feddan)

Operations	July		August		October		Total	
	HL(1)	FL(2)	HL	FL	HL	FL	HL	FL
Weeding	0.13	0.38	0.37	1.12			0.50	1.50
Cutting and collecting					2.20	6.60	2.20	6.60
Total	0.13	0.38	0.37	1.12	2.20	6.60	2.70	8.10

Source: Own calculations, ANNEX 2, Table 29.

1) Hired labour.
2) Family labour.

ANNEX 8
Table 37

Labour Requirement of the Scheme - Short-Term Measures (Reduced Water Supply)
Livestock
(Man-days per Year)

Item	No. of improved animals	Herding		Milking		Total man-days
		Man-days/ animal	Total man-days	Man-days/ animal	Total man-days	
Cows	50,299	15.72(1)	790,700	2.5(2)	125,748	916,448
Calves	30,672	15.72(1)	482,164	-	-	482,164
Young stock	63,335	15.72(1)	996,585	-	-	996,585
Feeder cattle	16,424	15.72(1)	258,185	-	-	258,185
Bulls	986	15.72(1)	15,500	-	-	15,500
Total labour demand for cattle			2,543,134	-	125,748	2,668,882
Sheep	24,636	11.46(3)	282,329	-	-	282,329
Goats	-	-	-	-	-	-
Total labour demand for sheep and goats			282,329			282,329
Total labour demand			2,825,463		125,748	2,951,211

Source: Own calculations, Volume II.

1) Feeding takes 5 minutes per day, cleaning of stalls taken 0.5 minutes per day, watering 10 minutes per day (always per animal) = 15.5 minutes per animal; 6 hours day, 365 days per year.
2) To milk one cow takes 10 minutes, i.e. 0.0278 man-days/cow/day (6 hours days); a cow is milked 180 days/ lactation; i.e. 90 days per year with a calving rate of 50 per cent.
3) Feeding takes 3 minutes per day, cleaning of stalls 0.3 minutes, watering 8 minutes (per animal); 6 hours day, 365 days per year.

Part II - Project-Economics

SUMMARY

In the second part of ANNEX 8 Support Measures have been costed and economically analyzed.

As Support Measures consist partly of modifications of measures already envisaged for implementation by the World Bank and partly of additional measures supporting the World Bank proposals, it was found necessary to distinguish between the two types of measures for calculating Project costs.

In order to present all costs of measures proposed for the initial rehabilitation phase Project costs as determined in Tables 44 - 49 include all measures irrespective wether these items represent modifications of or additional measures to the World Bank programme. In Table 50 these costs are summarized and total to LS 45.7 million including all contingencies.
In Table 51 the additional measures have been listed in order to determine the funds which would be required in addition to those ones already budgeted (earmarked) in the World Bank Appraisal Report.

The figures indicate:

- investment costs of LS 12.1 million
- operating costs of LS 5.6 million
- physical contingencies of LS 1.8 million
- financial contingencies of LS 6.4 million

and total costs of LS 25.9 million over the five year implementation period. Adding Project costs of the Livestock Component, RWS of LS 7.2 million (including all contingencies) funds required for the rehabilitation period would total to LS 33 million.

The economic analysis of additional Support Measures revealed an economic internal rate of return (EIRR) of 49.6 per cent, the high rate reflecting the fact that other rehabilitation measures (i.e. World Bank measures) necessary to achive the envisaged benefits have been considered as sunk costs not to be taken into account.

If the Livestock Component for the Reduced Water Supply situation is combined with the Support Measures as stated above, the EIRR would be reduced by 8.6 per cent points to 41 per cent.

The analysis of the balance of payment effects of the combined Project proposals for the Reduced Water Supply situation indicated positive net foreign exchange earnings already from year 3 onwards with US $ 8.4 million in year 3, reaching the highest level with US $ 27.2 million in year 12, thereafter falling to US $ 6.9 million in year 30.

The net foreign exchange earnings cumulated over the thirty year lifetime of the Project would total to about US $ 500 million.

1. Project Costs

Support Measures as part of the Phase II Rehabilitation Studies are designed to support the implementation of the Phase I measures, as appraised and approved by the World Bank (1). Support Measures comprise additional proposals concerning the organization, management and training sector, the co-operative sector, and the integration of the existing livestock into the Scheme, as well as a modification and extension of the World Bank programme. The World Bank programme has been revised and extented with respect to the Irrigation System (ANNEX 1), Agricultural Production and Engineering (ANNEXES 2 and 3) and with respect to General Buildings (Ginnery stores, ANNEX 16).

The additional proposals as mentioned above are dealt with in ANNEXES 6 (Co-operative Sector) and 7 (Organization, Management and Training) within this Volume and with respect to livestock in Volume II. The livestock proposals of that Volume include detailed cost estimates as well as a comprehensive financial and economic evaluation.

Project costs of Support Measures - excluding livestock - are presented in detail in Tables 45 to 49, with 6 supporting tables (39 to 44) and are summarized in Table 50. Support Measures are to be implemented simultanously with the World Bank programme, over an implementation period of 5 years, thus Project costs are shown in detail for this period. However, it is not assumed, that the programme could be implemented before 81, which implies a delay of almost 1 year in the implementation of the World Bank programme.

Costs reflect prices prevailing in the beginning of 1980 and are based on the official foreign exchange rate of US $ 1 = LS 0.5. (For details on this subject see ANNEX 19, Chapter 1).
Agricultural production costs for the four crops to be cultivated, namely cotton, groundnuts, grain and fodder sorghum, are calculated on an incremental basis only, with the first year however to be fully financed.
Based on these assumptions Project costs of Support Measures, as summarized in Table 50, would total to LS 33.3 million, of which LS 19.2 million would consist of investment costs (baseline costs). The foreign exchange component of investment costs is estimated at LS 14.9 million or 78 per cent, whilst for the operating costs of LS 14.1 million the foreign exchange component has been calculated at LS 4.8 million or 34 per cent, resulting in overall foreign exchange costs of LS 19.8 million or 59 per cent of total baseline costs.

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1) The Phase I Rehabilitation Study has been appraised in the Staff Appraisal Report No. 2608a-SU of April 1980 (Main Report) and of June 1980 (Implementation Volume).

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1) The Phase I Rehabilitation Study has been appraised in the Staff Appraisal Report No. 2608a-SU of April 1980 (Main Report) and of June 1980 (Implementation Volume).

If physical contingencies of 10 per cent are added, Support Measure costs total to LS 36.6 million. Financial contingencies have been compounded at 10 per cent annually over the 5 year implementation period and amount to LS 9.1 million or 24.8 per cent of Project costs (incl. physical contingencies). Thus the total Project costs of Support Measures amount to LS 45.7 million.

In order to supplement Support Measure costs by the costs of the Livestock Component - Reduced Water Supply RWS - as calculated and presented in Tables 82 to 94 of Volume II, these costs are presented as well in Table 50. However, production costs of fodder sorghum had to be deducted, as these costs have already been accounted for under crop production (Table 46). As can be seen from Table 50, Project costs would total to LS 52.9 million (incl. all contingencies) over the 5 year implementation period of the Support Measures if the costs of the Livestock Component - RWS are added to the costs of the Support Measures.

All Project cost figures discussed above do not reflect the fact, that part of the measures - although somehow modified - are already envisaged for implementation in the World Bank programme and that therefore funds have already been made available for these Project items.

Taking thus into account that only for the additional measures proposed in this study funds would be required, these additional funds have been calculated in Table 51. The calculations for that table are based on the assumption, that the modification of approved Phase I Measures (i.e. of the World Bank programme) as proposed in this study, would not result in higher costs as compared to the measures originally envisaged by the World Bank.

As can be seen from Table 51, additional funds required for the 5 year implementation period would amount to LS 25.9 million (incl. all contingencies) for the Support measures as compared to LS 45.7 million calculated as Project costs in Table 50, the difference being LS 19.8 million. Funds required for the Livestock component would be identical with Project costs as presented in Table 50, thus total additional funds required for all Project measures required for the initial rehabilitation programme would amount to LS 33.0 million of which LS 2.3 million represent physical and LS 8.0 million financial contingencies.

The foreign exchange component of additional funds required for the Support Measures amount to LS 18.1 million representing 55 per cent of total funds and 6 per cent or LS 1.8 million of total fund would constitute of import duties and taxes.

2. Economic Analysis

2.1 Introduction

In order to evaluate the effects of the Support Measures as presented in ANNEXES 1 to 7 of Volume I and ANNEX 16 of Volume II from an economic point of view, the Economic Internal Rate of Return (EIRR) of those measures will have to be determined. As Support Measures with respect to livestock have been analyzed separately in Volume II, the following analysis of Support Measures will be confined in the first instance to crop production only. After having analyzed Support Measures excluding livestock, the integrated Project proposals for the "Reduced Water Supply" RWS situation will be analyzed by combining the Livestock Component, RWS proposals with the Support Measures proposals.

2.2 Support Measures excluding Livestock

2.2.1 Support Measures Benefits

Benefits attributable to the Support Measures are defined as the economic value of net incremental production, which is the difference between the "incremental production with the Support Measures" and "incremental production without Support Measures".

2.2.1.1 Without Support Measures Benefits

For the "Without Support Measures Situation" it has been assumed that the Phase I Study proposals as appraised and modified by the World Bank in its Staff Appraisal Report would be implemented. The production volume to be expected with these modified Phase I measures however has to be revised as neither yields nor the envisaged areas cultivated are considered to be realistic. According to the detailed Phase II investigations with respect to irrigation water availability and requirements, which are presented in ANNEXES 1 and 9 resp., the maximum areas which could be cultivated with the available irrigation water would be much less than estimated previously in the Phase I Study. According to these investigations, the water utilization effiency without Support Measures can be assumed at 36 per cent. Due to the Support Measures the water utilization effiency is expected to increase to 48 per cent, thereby smoothening the effect of the declining irrigation water supply. The investigations of ANNEXES 1 and 2 revealed furthermore, that already from 1980 onwards, the cultivation of wheat as a winter crop would have to be given up, in order to cultivate the maximum area under summer crops, i.e. cotton and groundnuts. This option is clearly advantageous as

for 1 feddan cultivated with wheat, more than 2.5 feddan of cotton and/or groundnuts would have to be given up. (For details see ANNEX 2, Appendix B, Computed Areas under Available Water). If the findings with respect to available water and irrigable areas would have been available for the appraisal of the Phase I Study, it can reasonably be assumed, that wheat would have been dropped in favour of groundnuts and cotton as well.

In the World Bank Staff Appraisal Report, a rainfed fodder crop has been assumed as substitute for the declining wheat area. Although the fodder crop is not specified, the gross value of production is deemed to be unrealistic and not applicable in this context. Whilst the assumed farmgate price of LS 4/ton green fodder (financial value) seems to be appropriate, yield assumptions - increasing from 0.5 ton/feddan to a maximum of 0.8 ton/feddan - are considered as far too low, reflecting more likely grain sorghum yields.

For the present purposes, i.e. to determine the economic value of the fodder crop in the "Without Support Measures Situation", the production value of grain sorghum - representing an alternative rainfed cash crop - has been taken into account with an average yield of 400 kg per feddan.

The areas to be cultivated with sorghum have been assumed to be identical with those ones considered with Support Measures. With respect to cotton and groundnuts the maximum areas to be cultivated are determined by the irrigation water availability on the one side and the overall water efficiency on the other side. It has already been mentioned above that "Without Support Measures", namely without "double-ridge cultivation method, and without training of water khaffirs", the present overall water effiency of 36 per cent can not be expected to increase. Therefore this factor has been applied for calculating the maximum cotton and groundnut areas to be cultivated with the available irrigation water in the "Without Support Measures Situation".

With respect to yields to be expected by implementing the Appraisal Report programme, those ones assumed for cotton and groundnuts in the Staff Appraisal Report are considered as too optimistic. The yield increases as originally envisaged in the Phase I Study are still deemed appropriate and realistic. Table 52 presents a comparison of yield estimates as undertaken in the Phase I Study Report and the Staff Appraisal Report. As can be seen from Table 52, Appraisal Report estimates are substantially higher as compared to Phase I estimates, the difference in year 5 being 48 per cent for cotton and 59 per cent for groundnuts resp.

Taking into consideration that the measures envisaged in the Appraisal Report would not differ substantially from the Phase I Study proposals, the yields as originally estimated in the latter study have been applied in determining the production volume without Short-Term Measures.

The annual production of groundnuts, seed cotton and grain sorghum has been calculated over 30 years in Table 53. The figures presented in Table 53 indicate the effects of the declining irrigation water supply, as well as the effect of increased yields. As can be seen, groundnuts would be phoned out in year 28, whilst seed cotton production would fall from a maximum of 33,050 tons in year 5 to 3,965 tons in year 30.

In order to determine the economic benefits of the production as calculated in Table 53, economic farmgate prices, representative for the whole 30 year lifetime of Support Measures have to be applied. These prices have been calculated in ANNEX 18, Tables 1, 2 and 4. The calculations are based on 1990 long-term price forecasts as undertaken by the IBRD, and resulted in the following farmgate prices (1990 prices, expressed in 1980 constant terms):

- Seed cotton LS 751.7 per ton
- Groundnuts (unshelled) LS 279.2 per ton
- Grain sorghum LS 188.7 per ton.

Applying these prices, the economic benefits for the "Without Support Measures" situation have been calculated in Table 54.

2.2.1.2 Incremental Support Measures Benefits

Acreages cultivated as well as yields to be expected with the Support Measures have been discussed and determined in ANNEX 2 and in Part I of this ANNEX. The expected production in seed cotton, groundnuts, grain sorghum and fodder sorghum is presented in Table 22 of this ANNEX.

The economic value of seed cotton, groundnuts and grain sorghum has been determined by applying the economic farmgate prices as already discussed in Chapter 2.2.1.1 above. With respect to the economic valuation of fodder sorghum, the arguments as pur forward in the economic analysis of the livestock component as carried out in Volume II are valid too in this context. In Volume II the profitability and viability of the livestock component "as such", has been analyzed. This approach implied that fodder sorghum had to be costed with its opportunity costs, these being the economic value of grain sorghum, which would be cultivated as an alternative crop.

Following these arguments in the context of analyzing Support Measures excluding livestock, the economic value of grain sorghum production has to be assumed as well as for fodder sorghum. With these assumptions total benefits attributable to Support Measures only - excluding the Livestock Component RWS - can be determined. These benefits are calculated in Table 55. Deducting from the total benefit stream of Table 55 the benefits expected without Short-Term Measures as discussed and determined in the previous Chapter, the net incremental benefits attributable to the Support Measures can be calculated. These calculations are

presented as well in Table 55. It can be seen that the net incremental benefits would develop from LS 2,873 million to a maximum of LS 25,582 million in year 10, thereafter falling steadily to LS 3,334 million in year 30.

2.2.2 Support Measures Costs

The calculation of economic Support Measures costs is based on that of the financial costs as presented in Table 45 to 50.

These financial costs have been adjusted in two aspects, namely by:

- increasing the foreign exchange component costs by 130 per cent, which is due to the difference between the official exchange rate of US $ 1 = LS 0.5 and the shadow exchange rate of US $ = LS 1.15 (1),
- deducting the relevant import duties and taxes, as indicated in Table 39 to 50.

Economic costs for unskilled farm labour (hired or family) have been taken over with their financial value of LS 1 per man-day, as it is felt that the opportunity costs are at least as high as the financial costs, due to the shortage of labour within the Scheme.

On the basis of these assumptions, economic agricultural production costs have been calculated per feddan for the "without" and "with" Project situation. These calculations are presented in Tables 39 to 44. Applying the respective "without" values to the areas to be cultivated without Support Measures, as presented in Table 53, the agricultural production costs without Support Measures can be determined. These calculations are shown in Table 56. In Table 57, the respective calculations are carried out for the "With Support Measures" situation and by deducting the "without" cost stream of Table 56, the incremental agricultural production costs are determined. Likewise, all additional economic costs attributable to the Support Measures have been calculated and present in Table 58. The table presents a breakdown of costs into the various investment and operating costs. Both cost groups are increased by 10 per cent in order to provide for physical contingencies.

2.2.3 Economic Internal Rate of Return (EIRR)

On the basis of the calculations and assumptions made in the previous chapters, the economic internal rate of return (EIRR) of Support Measures has been calculated at 49.6 per cent. The high rate can be attributed to the specific circumstances prevailing in the Scheme, namely that:

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1) This subject is discussed in more detail in ANNEX 20.

- Support Measures do not represent the total package of immediate rehabilitation measures necessary to achieve the envisaged benefits; the major part of measures being already envisaged in the World Bank programme.
- Support Measures concentrate on the major constraint identified during the Phase II Rehabilitation Studies, this being the expected reduction in irrigable areas, caused by the progressive siltation of the reservoir.
- The measures proposed in this study to relieve the effect of the reducing water supply on the irrigable area are expected to be relatively inexpensive, (e.g. rehabilitation of Butcher's Weis, training of water khaffirs, double-ridge cultivation method) however, highly effective.

The latter argument is supported by a special sensitivity test, in which it has been analyzed how the EIRR would react if no increase in the overall water effiency would be realized by the Support Measures. The EIRR would then drop to 23.9 per cent.

In addition to the EIRR, the net present value and the benefit/cost ratio of Support Measures has been calculated. For these computations a discount rate of 10 per cent has been used, as it assumed, that this rate would reflect the opportunity costs of capital in the country. The computations revealed a benefit/cost ratio of 2.37 resulting from discounted benefit values of LS 167.5 million and discounted cost values of LS 70.8 million. The net present value totals thus to LS 96.7 million.

In order to analyze the effects of changes in key variables on the EIRR, several sensitivity tests have been carried out, the results being listed below:

	EIRR	SI (1)
- 10 per cent increase in costs	43.3	- 1.3
- 10 per cent reduction in costs	57.5	1.6
- 10 per cent increase in benefits	56.7	1.4
- 10 per cent reduction in benefits	42.7	- 1.4

The figures of the sensitivity tests indicate that 10 per cent changes in either costs of benefits effect the EIRR by more than 10 per cent, ranging between 13 and 16 per cent. Compared to the analysis carried out for the Livestock Components in Volume II, the reactions are, however, remarkable stable, as the SI's calculated in that Volume exceeded even the level of 20.

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1) The Sensitivity Indicator (SI) is defined as

$$SI = \frac{\text{percentage of change in the EIRR}}{\text{percentage of change in the variable tested.}}$$

2.3 Support Measures including Livestock

In order to evaluate the combined proposals for the "Reduced Water Supply" (RWS) situation, economic costs and benefits of the Livestock Component, RWS as determined in Volume II, Chapter 2.9.1 have to be combined with the cost and benefit stream as determined in the previous chapters and as presented in Table 55 and 58. The combined benefits for both Project components are presented in Table 59. The incremental crop production benefit stream of that table differs from that one presented in Table 55, as the value of the fodder crop had to be omitted. Incremental livestock production benefits have been taken over unchanged from Volume II, Table 101.

The combined Project costs are presented in Table 60. Whilst investment costs of both components are not effected by the integration, operational costs of Support Measures had to be increased due to the higher agricultural production costs of fodder sorghum as compared to grain sorghum. On the other side, operational costs of the Livestock Component, RWS, had to be adjusted by the economic costs of fodder sorghum.

With these adjustments, the EIRR of the integrated proposals for the RWS situation had been calculated, resulting in a value of 41 per cent The integration of the Livestock Component, RWS, thus reduces the EIRR by 8.6 per cent points, a result, which would be expected from the economic analysis as undertaken in Volume II, Chapter 2.9.1 . The benefit/cost ratio drops to 1.94 resulting from discounted benefits of LS 214.1 million and discounted costs of LS 110.1 million. The net present value of combined Project components, however, increase from LS 96.7 million to LS 104 million.

2.4 Balance of Payments Effects

In order to demonstrate the impact of Project proposals, desinged for the Reduced Water Supply (RWS) situation, on the country's balance of payment, the attributable foreign exchange costs and earnings have already been carried out for the separate economic analysis of the Livestock Component, RWS in Volume II. The calculation revealed that already in the second Project year, foreign exchange earnings would exceed its foreign exchange costs, with the cumulative balance being positive from year 3 onwards. Support Measures would have a similar beneficial effect on Sudan's balance of payments, as will be shown in Tables 61 and 62. In Table 61, foreign exchange spendings due to the Support Measures have been listed under the same headings as Project costs have been presented in Table 45 to 60. Foreign exchange costs have been calculated by applying the respective percentage as estimated in the Project cost tables.

On the other side the incremental production of cotton, groundnuts and grain sorghum, which would be exported, would result in foreign exchange earnings. The three commodities have been valued at their c.i.f. Port Sudan prices, according to the assumptions and forecasts made in ANNEX 18. Their foreign exchange value expressed in US $ would then be:

- cotton lint 1,822 US $/ton
- groundnuts (shelled) 561 US $/ton
- grain sorghum 195 US $/ton.

With an extraction rate of 380 kg lint per ton seed cotton, the value of seed cotton would amount to US $ 692.36 per ton, whilst the value of unshelled groundnuts would be US $ 336.72 per ton, assuming a conversion rate of 1:0.6.

Table 62 summarizes the annual foreign exchange earnings as well as costs as determined in Table 61 over the 30 year lifetime of the Project.
It can be seen that foreign exchange costs would exceed foreign exchange earnings in the initial two years of Project implementation. In Project year 3, foreign exchange spendings would be more than offset by foreign exchange earnings, and in year 4 all previous spending would have been recuperated.
If these results are compared with the balance of payments effects of the Livestock Component, RWS only it becomes obvious, that the positive effects on the country's balance of payments are delayed by 1 year. However, already in year 4, the cumulated net foreign exchange earnings of the combined Project components would be higher than those ones, calculated for the Livestock Component, RWS only.
If the net foreign exchange earnings are cumulated over 30 years, as presented in Table 62, they would total to about 500 million.

ANNEX 8
Table 39

Calculation of Cotton Production Costs without Project
(Financial and Economic Costs in LS per Feddan)

Item	Percentage of		Year 1		Year 2		Year 3		Year 4		Year 5		Years 6-30	
	foreign exchange	taxes	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.
1. Agricultural machinery														
- Variable machinery costs	65	5	6.65	11.94	6.65	11.94	8.65	15.53	8.65	15.53	8.65	15.53	8.65	15.53
- Aerial spraying	70	5	19.16	35.64	19.16	35.64	19.16	35,64	19.16	35.64	19.16	35.64	19.16	35.64
2. Labour	-	-	32.3	32.3	34.31	34.31	33.82	33.82	34.63	34.63	36.25	36.25	36.25	36.25
3. Material inputs														
- Seeds	60	5	1.0	1.73	1.0	1.73	1.0	1.73	1.0	1.73	1.0	1.73	1.0	1.73
- Fertilizers	80	10	10.13	19.65	10.13	19.65	10.13	19.65	10.13	19.65	10.13	19.65	10.13	19.65
4. Total production costs			69.24	101.26	71.25	103.27	72.76	106.37	73.57	107.18	75.19	108.8	75.19	108.8

Source: ANNEX 3, Table 8 and ANNEX 8, Table 24.
WORLD BANK: New Halfa Irrigation Rehabilitation Project. Implementation Volume. Staff Appraisal. Report No. 2608. SU. Washington 1980, ANNEX 7, Table 1, p. 68.

ANNEX 8
Table 42

Calculation of Groundnut Production Costs with Project
Financial and Economic Costs in LS per Feddan)

Item	Percentage of		Year 1		Year 2		Year 3		Year 4		Year 5		Year 6-30	
	foreign exchange	taxes	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.	fin.	econ.
1. Agricultural machinery	65	5	13.59	24.39	13.71	24.61	13.82	24.81	13.94	25.02	14.05	25.22	14.05	25.22
2. Labor	-	-	18.75	18.75	18.55	18.55	18.31	18.31	18.06	18.06	17.8	17.8	18.82	18.82
3. Seeds	10	-	4.75	4.87	4.93	5.19	5.11	5.51	5.29	5.84	5.48	6.19	5.48	6.19
4. Total production costs			37.09	48.01	37.21	48.35	37.29	48.63	37.38	48.92	37.47	49.21	38.35	50.23

Source: ANNEX 3, Table 8 and ANNEX 8, Table 24.

ANNEX 8
Table 43

Calculation of Grain Sorghum Production Costs without and with Project
(Financial and Economic Costs in LS per Feddan)

Item	Percentage of foreign exchange	taxes	Without Project Fin.	Without Project Econ.	With Project Fin.	With Project Econ.
1. Agricultural machinery	65	5	2.54	4.56	3.21	5.76
2. Labour	-	-	7.00	7.00	6.00	6.00
3. Seeds	-	-	0.28	0.28	0.34	0.34
4. Total production costs			9.82	11.84	9.55	12.10

Sources: ANNEX 3, Table 8 and ANNEX 8, Table 25.
WORLD BANK: New Halfa Irrigation Rehabilitation Project. Implementation Volume. Staff Appraisal. Report No. 2608. SU. Washington 1980, ANNEX 7, Table 4, p. 77.

ANNEX 8
Table 44

Calculation of Fodder Crop Production Costs with Project

Item	Percentage of foreign exchange	taxes	Costs in LS per feddan financial	economic
1. Agricultural machinery	65	5	3.21	5.76
2. Labour	-	-	10.80	10.80
3. Seeds	-	-	1.52	1.52
4. Total production costs			15.53	18.08

Source: ANNEX 3, Table 8 and ANNEX 8, Table 26.

Project Costs, Support Measures: Irrigation System

Expenditure item	Unit	Unit cost in LS	Total number of units	Year 1 No.	Year 1 Costs in LS	Year 2 No.	Year 2 Costs in LS	Year 3 No.	Year 3 Costs in LS	Year 4 No.	Year 4 Costs in LS	Year 5 No.	Year 5 Costs in LS	Total Years 1 - 5 Total cost in LS	Foreign exchange costs %	Foreign exchange costs in LS	Local costs in LS	Taxes and duties in % of tot. costs %	Taxes and duties in % of tot. costs in LS
Investment costs																			
Rehabilitation of the Butcher's Weirs	set	4,500	1	1	4,500		-		-		-		-	4,500	70	3,150	1,350	10	450
Motorcycles	piece	1,000	89	18	18,000	18	18,000	17	17,000	18	18,000	18	18,000	89,000	60	53,400	35,600	25	22,250
Training equipment	set	100	13	13	1,300		-		-		-		-	1,300	70	910	390	5	65
Total investment costs					23,800		18,000		17,000		18,000		18,000	94,800	61	57,460	37,340	24	22,765
Operating costs																			
Maintenance of quaternary canals (1)	hawasha	3.5	116,639	23,100	80,850	22,581	79,034	22,932	80,262	23,545	82,408	24,481	85,684	408,238	65	265,355	142,883	5	20,412
Running costs of motorcycles	piece	400	213	18	7,200	36	14,400	53	21,200	53	21,200	53	21,200	85,200	65	55,380	29,820	5	4,260
Salaries and wages																			
Head khaffirs	man-year	600	213	18	10,800	36	21,600	53	31,800	53	31,800	53	31,800	127,800	-	-	127,800	-	-
Daily allowance	man-day	2	8,166	1,560	3,120	1,950	3,900	2,324	4,648	1,166	2,332	1,166	2,332	16,332	-	-	16,332	-	-
Total operating costs					101,970		118,934		137,910		137,740		141,016	637,570	50	320,735	316,835	4	24,672
Total base-line costs					125,770		136,934		154,910		155,740		159,016	732,370	52	378,195	354,175	6	47,437
Physical contingencies (10%)					12,577		13,693		15,491		15,574		15,902	73,237	52	37,820	35,417	6	4,744
Total incl. physical contingencies					138,347		150,627		170,401		171,314		174,918	805,607	52	416,015	389,592	6	52,181
Financial contingencies (10% annually)					13,835		31,632		56,403		79,507		106,787	288,164	52	149,845	138,319	6	17,290
Total costs					152,182		182,259		226,804		250,821		281,705	1,033,771	52	565,860	527,911	6	69,471

Source: Own calculations.

1) This item represents a modification of the respective World Bank proposal.

ANNEX 8
Table 46

Project Costs. Support Measures: Agricultural Production

Expenditure item	Unit	Unit cost	Total number of units	Year 1 No.	Year 1 Costs	Year 2 No.	Year 2 Costs	Year 3 No.	Year 3 Costs	Year 4 No.	Year 4 Costs	Year 5 No.	Year 5 Costs	Total Years 1 - 5 Total cost	Foreign exchange costs %	Foreign exchange costs in LS	Local costs in LS	Taxes and duties in %	Taxes and duties of total cost in LS
		in LS			in LS		in LS		in LS		in LS		in LS	in LS					
Investment costs																			
Area cultivated in the traditional method (1)																			
Tractor, 75 HP	piece	9,500	275	275	2,612,500		-		-		-		-	2,612,500	80	2,090,000	522,500	5	130,625
Disc plough, 4 furrow	piece	1,200	143	143	178,750		-		-		-		-	178,750	80	143,000	35,750	5	8,938
Disc harrow	piece	3,300	143	143	471,900		-		-		-		-	471,900	80	377,520	94,380	5	23,595
Ridger	piece	1,800	201	201	241,200		-		-		-		-	241,200	80	192,960	48,240	5	12,060
Grain drill	piece	6,000	86	86	516,000		-		-		-		-	516,000	80	412,800	103,200	5	25,800
Groundnut combine	piece	10,000	103	103	1,030,000		-		-		-		-	1,030,000	80	824,000	206,000	5	51,500
Sub-total					5,050,350		-		-		-		-	5,050,350	80	4,040,280	1,010,070	5	252,518
Area cultivated with the double-ridge method																			
Crawler tractor, 105 HP	piece	33,000	180	35	1,155,000	33	1,089,000	34	1,122,000	39	1,287,000	39	1,287,000	5,940,000	80	4,752,000	1,188,000	5	297,000
Tractor, 75 HP	piece	9,500	49	49	465,500		-		-		-		-	465,500	80	372,400	93,100	5	23,275
Offset ploughing, D.H.	piece	5,000	111	22	110,000	20	100,000	21	105,000	24	120,000	24	120,000	555,000	80	444,000	111,000	5	27,750
Offset, D.H.	piece	5,000	159	31	155,000	29	145,000	30	150,000	34	170,000	35	175,000	795,000	80	636,000	159,000	5	39,750
Abu Sita ditcher	piece	2,000	81	16	32,000	14	28,000	16	32,000	17	34,000	18	36,000	162,000	80	129,600	32,400	5	8,100
4 row planter	piece	1,900	156	31	58,900	29	55,100	29	55,100	34	64,600	33	62,700	295,400	80	237,120	59,280	5	14,820
Rolling cultivator	piece	2,000	96	19	38,000	17	34,000	18	36,000	20	40,000	22	44,000	192,000	80	153,600	38,400	5	9,600
Seed drill	piece	6,000	19	19	114,000		-		-		-		-	114,000	80	91,200	22,800	5	5,700
Groundnut combine	piece	10,000	23	23	230,000		-		-		-		-	230,000	80	184,000	46,000	5	11,500
Ridger	piece	4,000	159	31	124,000	29	116,000	30	120,000	34	136,000	35	140,000	636,000	80	508,800	127,200	5	31,800
Motor grader	piece	65,000	10	2	130,000	2	130,000	2	130,000	2	130,000	2	130,000	650,000	80	520,000	130,000	5	32,500
Low loader	piece	20,000	1	1	20,000		-		-		-		-	20,000	80	16,000	4,000	5	1,000
Sub-total					2,632,400		1,697,100		1,750,100		1,981,600		1,994,700	10,055,900	80	8,044,720	2,011,180	5	502,795
Total investment costs					7,682,750		1,697,100		1,750,100		1,981,600		1,994,700	15,106,250	80	12,085,000	3,021,250	5	755,313
Operating costs																			
Incremental agricultural production costs (2)																			
Cotton					4,302,370		-		85,016		131,814		188,713	4,707,913	40	1,883,167	2,824,751	4	188,31
Groundnuts					2,115,206		-		33,715		58,185		87,803	2,294,774	34	780,223	1,514,551	3	68,84
Grain sorghum					154,482		-		-		27,504		27,205	206,194	22	45,363	160,831	2	4,12
Fodder sorghum					390,578		49,851		69,730		38,825		54,665	611,650	15	91,747	519,903	1	61,16
Sub-total					6,967,636		49,851		188,461		256,328		358,260	7,820,536	38	2,800,500	5,020,036	4	322,44
Salaries and wages																			
Counterparts	man-year	2,000	10	2	4,000	2	4,000	2	4,000	2	4,000	2	4,000	20,000	-	-	20,000	-	-
Machinery managers head office	man-year	1,500	5	1	1,500	1	1,500	1	1,500	1	1,500	1	1,500	7,500	-	-	7,500	-	-
Machinery supervisors, block office	man-year	1,200	95	19	22,800	19	22,800	19	22,800	19	22,800	19	22,800	114,000	-	-	114,000	-	-
Mechanics, block office	man-year	900	190	38	34,200	38	34,200	38	34,200	38	34,200	38	34,200	171,000	-	-	171,000	-	-
Tractor drivers	man-year	900	2,470	399	350,100	438	394,200	489	440,100	548	493,200	606	545,400	2,223,000	-	-	2,223,000	-	-
Sub-total					412,600		456,700		502,600		555,700		607,900	2,535,500	-	-	2,535,500	-	-
Total operating costs					7,380,236		506,551		691,061		812,028		966,160	10,356,036	27	2,800,500	7,555,536	3	322,44
Total base-line costs					15,062,986		2,203,651		2,441,161		2,793,628		2,960,860	25,462,286	58	14,885,500	10,576,786	3	1,077,76
Physical contingencies (10%)					1,506,299		220,365		244,116		279,363		296,086	2,546,229	58	1,488,550	1,057,679	3	107,77
Total incl. physical contingencies					16,569,285		2,424,016		2,685,277		3,072,991		3,256,946	28,008,515	58	16,374,050	11,634,465	3	1,185,53
Financial contingencies (10% annually)					1,656,929		509,043		888,827		1,426,175		1,988,396	6,469,340	58	3,752,216	2,717,124	3	194,08
Total costs					18,226,214		2,933,059		3,574,104		4,499,166		5,245,342	34,477,855	58	20,126,266	14,351,589	3	1,379,61

Source: Own calculations.

1) These items represent a modification of the respective World Bank proposals.
2) Only incremental production costs have been taken into account, as costs will be repaid by the farmers in the following season.

Project Costs, Support Measures: Cooperative Sector

Expenditure item	Unit	Unit cost	Total number of units	Year 1		Year 2		Year 3		Year 4		Year 5		Total Years 1 - 5					Taxes and duties in % of total costs
				No.	Costs	No.	Costs	No.	Costs	No.	Costs	No.	Costs	Total cost		Foreign exchange costs	Local costs		
		in LS			in LS		in LS		in LS		in LS		in LS	in LS	%	in LS	in LS	%	in LS
Investment costs																			
Farm machinery shed and equipment	building	1,000	35	8	8,000	19	19,000	2	2,000	2	2,000	4	4,000	35,000	80	28,000	7,000	10	3,500
Union workshop equipment	set	5,250	1	1	5,250		-		-		-		-	5,250	80	4,200	1,050	10	525
"Nomad" workshop	building	20,000	2	1	20,000		-		-	1	20,000		-	40,000	50	20,000	20,000	15	6,000
"Nomad" workshop equipment	set	2,500	1	1	2,500		-		-		-		-	2,500	80	2,000	500	10	250
Office and bookkeeping equipment	set	150	35	8	1,200	19	2,850	2	300	2	300	4	600	5,250	60	3,150	2,100	20	1,050
Vehicles	piece	9,300	4	2	18,600		-		-		-	2	18,600	37,200	65	24,180	13,020	25	9,300
Ministry of Cooperatives, office equipment	set	1,000	1	1	1,000		-		-		-		-	1,000	60	600	400	20	200
Total investment costs					56,550		21,850		2,300		22,300		23,200	126,200	65	82,130	44,070	17	20,825
Operating costs																			
Farm machinery shed and equipment	sum	50	5	1	50	1	50	1	50	1	50	1	50	250	55	138	112	10	25
Union workshop equipment	sum	250	5	1	250	1	250	1	250	1	250	1	250	1,250	55	688	562	10	125
"Nomad" workshop	sum	400	5		-	1	400	1	400	1	400	2	800	2,000	55	1,100	900	10	200
"Nomad" workshop equipment	sum	125	5	1	125	1	125	1	125	1	125	1	125	625	55	344	281	10	63
Vehicles	sum	4,940	10	2	9,880	2	9,880	2	9,880	2	9,880	2	9,880	49,400	65	32,110	17,290	5	2,470
Salaries and wages																			
Tractor manager	man-year	2,000	90		-	19	38,000	21	42,000	23	46,000	27	54,000	180,000	-	-	180,000	-	-
Bookkeeper	man-year	1,200	90		-	19	22,800	21	25,200	23	27,600	27	32,400	108,000	-	-	108,000	-	-
Mechanic	man-year	900	150	15	13,500	30	27,000	35	31,500	35	31,500	35	31,500	135,000	-	-	135,000	-	-
Storekeeper	man-year	900	16	1	900	3	2,700	4	3,600	4	3,600	4	3,600	14,400	-	-	14,400	-	-
Total operating costs					24,705		101,205		113,005		119,405		132,605	490,925	7	34,380	456,545	1	2,883
Total base-line costs					81,955		123,055		115,305		141,705		155,805	617,125	19	116,510	500,615	4	23,708
Physical contingencies (10%)					8,126		12,306		11,531		14,171		15,581	61,715	19	11,652	50,063	4	2,371
Total incl. physical contingencies					89,381		135,361		126,836		155,876		171,386	678,840	19	128,162	550,678	4	26,079
Financial contingencies (10% annually)					8,938		28,426		41,983		72,342		104,633	256,322	19	48,392	207,930	4	9,847
Total costs					98,319		163,787		168,819		228,218		276,019	935,162	19	176,554	758,608	4	35,926

Source: Own calculations.

Project Costs, Support Measures: Management and Training

Expenditure item	Unit	Unit cost	Total number of units	Year 1		Year 2		Year 3		Year 4		Year 5		Total Years 1 - 5				Taxes and duties in % of total cos
				No.	Costs	No.	Costs	No.	Costs	No.	Costs	No.	Costs	Total cost	Foreign exchange costs		Local costs	
		in LS			in LS		in LS		in LS		in LS		in LS	in LS	%	in LS	in LS	%
Investment costs																		
ABS-Credit Service																		
Vehicles	piece	9,300	38	19	176,700	-	-	-	-	-	-	19	176,700	353,400	65	229,710	123,690	35
Safes	piece	500	19	19	9,500	-	-	-	-	-	-	-	-	9,500	80	7,600	1,900	10
Office equipment, Blocks	set	500	19	19	9,500	-	-	-	-	-	-	-	-	9,500	60	5,700	3,800	20
Office equipment, Sections	set	200	6	6	1,200	-	-	-	-	-	-	-	-	1,200	60	720	480	20
Sub-total					196,900		-		-		-		176,700	373,600	65	243,730	129,870	24
Tenant Credit Unit																		
Vehicles	piece	9,300	8	4	37,200	-	-	-	-	-	-	4	37,200	74,400	65	48,360	26,040	25
Motorcycles	piece	1,000	50	25	25,000	-	-	-	-	25	25,000	-	-	50,000	65	32,500	17,500	25
Office equipment	set	500	17	17	8,500	-	-	-	-	-	-	-	-	8,500	60	5,100	3,400	20
Sub-total					70,700		-		-		25,000		37,200	132,900	65	85,960	46,940	25
Extension Service																		
Vehicles	piece	9,300	30	15	139,000	-	-	-	-	-	-	15	139,000	278,000	65	180,700	97,300	25
Motorcycles	piece	1,000	128	64	64,000	-	-	-	-	64	64,000	-	-	128,000	65	83,200	44,800	25
Extension kit	set	10	132	132	1,320	-	-	-	-	-	-	-	-	1,320	70	924	396	5
Training equipment	set	1,000	1	1	1,000	-	-	-	-	-	-	-	-	1,000	70	700	300	5
Sub-total					205,320		-		-		64,000		139,000	408,320	65	265,524	142,796	25
Farm mechanization training																		
Vehicles	piece	9,300	10	5	46,500	-	-	-	-	-	-	5	46,500	93,000	65	60,450	32,550	25
Senior house, category 1	house	56,055	3	3	168,165	-	-	-	-	-	-	-	-	168,165	50	84,083	84,082	15
Sub-total					214,665		-		-		-		46,500	261,165	55	144,533	116,632	19
Total investment costs					687,585		-		-		89,000		399,400	1,175,985	63	739,747	436,238	23
Operating costs																		
T.A.V.																		
Internationally recruited adviser	man-year	41,000	3	1	41,000	1	41,000	1	41,000		-		-	123,000	100	123,000	-	-
ABS-Credit Service																		
Vehicles	sum	4,940	95	19	93,860	19	93,860	19	93,860	19	93,860	19	93,860	469,300	65	305,045	164,255	5
Salaries																		
Agricultural credit officer	man-year	1,500	95	19	28,500	19	28,500	19	28,500	19	28,500	19	28,500	142,500	-	-	142,500	-
Clerical staff	man-year	1,000	30	6	6,000	6	6,000	6	6,000	6	6,000	6	6,000	30,000	-	-	30,000	-
Sub-total					128,360		128,360		128,360		128,360		128,360	641,800	48	305,045	336,755	4
Tenant Credit Unit																		
Vehicles	sum	4,940	20	4	19,760	4	19,760	4	19,760	4	19,760	4	19,760	98,800	65	64,220	34,580	5
Motorcycles	sum	400	125	25	10,000	25	10,000	25	10,000	25	10,000	25	10,000	50,000	65	32,500	17,500	5
Section officer	man-year	1,500	20	4	6,000	4	6,000	4	6,000	4	6,000	4	6,000	30,000	-	-	30,000	-
Daily allowance	man-day	2	1,392	696	1,392	174	348	174	348	174	348	174	348	2,784	-	-	2,784	-
Sub-total					37,152		36,108		36,108		36,108		36,108	181,584	53	96,720	84,864	4
Extension Service																		
Vehicles	sum	4,940	75	15	74,100	15	74,100	15	74,100	15	74,100	15	74,100	370,500	65	240,825	129,675	5
Motorcycles	sum	400	320	64	25,600	64	25,600	64	25,600	64	25,600	64	25,600	128,000	65	83,200	44,800	5
Daily allowance	man-day	2	6,864	3,696	7,392	792	1,584	792	1,584	792	1,584	792	1,584	13,728	-	-	13,728	-
Sub-total					107,092		101,284		101,284		101,284		101,284	512,228	63	324,025	188,203	5
Farm mechanization training																		
Vehicles	sum	4,940	25	5	24,700	5	24,700	5	24,700	5	24,700	5	24,700	123,500	65	80,275	43,225	5
Running of training centre	lump sum	25,000	5	1	25,000	1	25,000	1	25,000	1	25,000	1	25,000	125,000	-	-	125,000	-
Maintenance of houses	sum	1,120	12	-	-	3	3,360	3	3,360	3	3,360	3	3,360	13,440	40	5,376	8,064	10
Salaries of expatriates	man-year	41,000	15	5	205,000	5	205,000	3	123,000	1	41,000	1	41,000	615,000	100	615,000	-	-
Sub-total					254,700		258,060		176,060		94,060		94,060	876,940	80	700,651	176,289	1
Total operating costs					568,304		564,812		482,812		369,812		369,812	2,335,552	66	1,549,441	786,111	3
Total base-line costs					1,255,889		564,812		482,812		458,812		769,212	3,511,537	66	2,289,188	1,222,349	10
Physical contingencies (10%)					125,589		56,481		48,281		44,881		77,921	351,153	65	228,918	122,235	10
Total costs incl. physical contingencies					1,381,478		621,293		531,093		493,693		847,133	3,862,690	65	2,518,106	1,344,584	10
Financial contingencies (10% annually)					138,148		130,472		179,792		229,123		509,857	1,183,392	65	771,459	411,933	10
Total costs					1,519,626		751,765		706,885		722,816		1,356,990	5,046,082	65	3,289,565	1,756,517	10

Source: Own calculations.

ANNEX 8
Table 49

Project Costs, Support Measures: General Buildings

Expenditure item	Unit	Unit cost	Total number of units	Year 1		Year 2		Year 3		Year 4		Year 5		Total Years 1 - 5				Taxes, duties
		in LS		No.	Costs in LS	No.	Costs in LS	No.	Costs in LS	No.	Costs in LS	No.	Costs in LS	Total cost in LS	Foreign exchange costs %	Foreign exchange costs in LS	Local costs in LS	of to %
Investment costs																		
Fuel storage (1)																		
Diesel tanks (90kl)	piece	7,000	6	2	14,000	1	7,000	1	7,000	1	7,000	1	7,000	42,000	80	33,600	8,400	10
Diesel tanks (31.5 kl)	piece	3,100	10	2	6,200	2	6,200	2	6,200	2	6,200	2	6,200	31,000	80	24,800	6,200	10
Petrol tanks (90 kl)	piece	7,000	1	1	7,000	-	-	-	-	-	-	-	-	7,000	80	5,600	1,400	10
Petrol tanks (27 kl)	piece	2,800	3	1	2,800	1	2,800	1	2,800	-	-	-	-	8,400	80	6,720	1,680	10
Petrol tanks (13.5 kl)	piece	1,800	2	1	1,800	1	1,800	-	-	-	-	-	-	3,600	80	2,880	720	10
Petrol pumps	no.	3,200	10	7	22,400	2	6,400	1	3,200	-	-	-	-	32,000	85	27,200	4,800	10
Lubricant sheds ($8.75 m^2$)	m^2	600	15	7	4,200	3	1,800	3	1,800	1	600	1	600	9,000	50	4,500	4,500	10
Tanker trucks (2,500 gals)	piece	7,000	3	2	14,000	1	7,000	-	-	-	-	-	-	21,000	60	12,600	8,400	25
Tanker-trailer trucks (5,000 gals)	piece	20,000	2	1	20,000	1	20,000	-	-	-	-	-	-	40,000	60	24,000	16,000	25
Sub-total					92,400		53,000		21,000		13,800		13,800	194,000	73	141,900	52,100	15
Renovation of workshop buildings (1)																		
in New Halfa	sum	86,410	1	1	86,410		-		-		-		-	86,410	50	43,205	43,205	10
at Block Headquart.	sum	13,000	11	3	39,000	2	26,000	2	26,000	2	26,000	2	26,000	143,000	50	71,500	71,500	10
Sub-total					125,410		26,000		26,000		26,000		26,000	229,410	50	114,705	114,705	10
Stores																		
Insecticides sheds (1)	m^2	115	608	204	23,322	101	11,661	101	11,661	101	11,661	101	11,661	69,966	75	52,475	17,491	15
General stores (1)	m^2	145	11,120	2,880	417,600	2,300	333,500	2,160	313,200	2,160	313,200	1,620	234,900	1,612,400	75	1,209,300	403,100	15
Cinnery store	m^2	155	4,000	2,000	310,000	2,000	310,000	-	-	-	-	-	-	620,000	75	465,000	155,000	15
Sub-total					750,922		655,161		324,861		324,861		246,561	2,302,366	75	1,726,775	575,591	15
Total investment costs					968,732		734,161		371,861		364,661		286,361	2,725,776	73	1,983,380	742,396	15
Operating costs																		
Fuel storage																		
Maintenance of tanks and pumps					-		2,710		3,920		4,880		5,540	17,050	60	10,230	6,820	10
Maintenance of lubricant sheds					-		84		120		156		168	528	40	211	317	10
Running costs of tanker trucks 30,000 km	sum	3,262	14	2	6,524	3	9,786	3	9,786	3	9,786	3	9,786	45,668	65	29,684	15,984	5
Running costs of tanker-trailer trucks (30,000 km)	sum	6,566	9	1	6,566	2	13,132	2	13,132	2	13,132	2	13,132	59,094	65	38,411	20,683	5
Sub-total					13,090		25,712		26,958		27,954		29,626	122,340	64	78,536	43,804	6
Stores (1)																		
Maintenance of new stores					-		15,018		28,122		34,619		41,116	118,875	55	65,381	53,494	10
Total operating costs					13,090		40,730		55,080		62,573		69,742	241,215	60	143,917	97,298	8
Total base-line costs					981,822		774,891		426,941		427,234		356,103	2,966,991	72	2,127,297	839,694	14
Physical contingencies (10%)					98,162		77,489		42,694		42,723		35,610	296,698	72	212,729	83,969	14
Total incl. physical contingencies					1,080,004		852,380		469,635		469,957		391,713	3,263,689	72	2,340,026	923,663	14
Financial contingencies (10% annually)					108,000		172,000		155,449		219,107		239,141	899,697	72	647,782	251,915	14
Total costs					1,188,004		1,031,380		625,084		688,064		630,854	4,163,386	72	2,987,808	1,175,578	14

Source: Own calculations.

1) These items represent a modification of the respective World Bank proposals.

ANNEX 8
Table 50

Summary of Project Costs, Support Measures (Including World Bank Proposals)

Expenditure item	Year 1	Year 2	Year 3	Year 4	Year 5	Total Years 1 - 5					Taxes and duties in % of total costs
	Costs in LS	Costs in LS	Costs in LS	Costs in LS	Costs in LS	Total cost in LS	Foreign exchange costs %	Foreign exchange costs in LS	Local costs in LS	Taxes and duties in % of total costs %	Taxes and duties in % of total costs in LS
Investment costs											
Irrigation system	23,800	18,000	17,000	18,000	18,000	94,800	61	57,460	37,340	24	22,765
Agricultural production	7,682,750	1,697,100	1,750,100	1,981,600	1,994,700	15,106,250	80	12,085,000	3,021,250	5	755,313
Organization, management and training	687,585	-	-	89,000	399,400	1,175,985	63	739,747	436,238	23	274,331
Cooperative sector	56,550	21,850	2,300	22,300	23,200	126,200	65	82,130	44,070	17	20,825
General buildings	968,732	734,161	371,861	364,661	286,361	2,725,776	73	1,983,380	742,396	15	396,846
Total investment costs	9,419,417	2,471,111	2,141,261	2,475,561	2,721,661	19,229,011	78	14,947,717	4,281,294	8	1,470,080
Operating costs											
Irrigation system	101,970	118,934	137,910	137,740	141,016	637,570	50	320,735	316,835	4	24,672
Agricultural production	7,380,236	506,551	691,061	812,028	966,160	10,356,036	27	2,800,500	7,555,536	3	322,449
Organization, management and training	568,304	564,812	482,812	359,812	359,812	2,335,552	66	1,549,441	786,111	3	63,349
Cooperative sector	24,705	101,205	113,005	119,405	132,605	490,925	7	34,380	456,545	1	2,883
General buildings	13,090	40,730	55,080	62,573	69,742	241,215	60	143,917	97,298	8	18,884
Total operating costs	8,088,305	1,332,232	1,479,868	1,491,558	1,669,335	14,061,298	34	4,848,973	9,212,325	3	432,237
Total base-line costs	17,507,722	3,803,343	3,621,129	3,967,119	4,390,996	33,290,309	59	19,796,690	13,493,619	6	1,902,317
Physical contingencies (10%)	1,750,772	380,334	362,113	396,712	439,100	3,329,031	59	1,979,669	1,349,362	6	190,232
Total incl. physical contingencies	19,258,494	4,183,677	3,983,242	4,363,831	4,830,096	36,619,340	59	21,776,359	14,842,981	6	2,092,549
Financial contingencies (10% annually)	1,925,849	878,572	1,318,453	2,025,300	2,948,774	9,096,948	59	5,409,666	3,687,282	6	519,829
Total Project Costs of Support Measures	21,184,343	5,062,249	5,301,695	6,389,131	7,778,870	45,716,288	59	27,186,025	18,530,263	6	2,612,378
Project costs, Livestock Component RWS											
Investment costs	1,369,312	393,995	564,106	384,582	615,880	3,327,875	21	704,456	2,623,419	7	216,598
Operating costs	297,706	567,214	296,545	252,205	269,354	1,683,024	41	697,836	985,188	4	60,934
Total base-line costs	1,667,018	961,209	860,651	636,787	885,234	5,010,899	28	1,402,292	3,608,607	6	277,532
Physical contingencies (10%)	166,702	96,121	86,065	63,679	88,523	501,090	28	140,229	360,861	6	27,753
Total incl. physical conting.	1,833,720	1,057,330	946,716	700,466	973,757	5,511,989	28	1,542,521	3,969,468	6	305,285
Financial contingencies (10% annually)	183,372	222,039	313,363	325,086	594,479	1,638,339	28	458,486	1,179,853	6	90,740
Total Project costs, Livestock Component, RWS	2,017,092	1,279,369	1,260,079	1,025,552	1,568,236	7,150,328	28	2,001,007	5,149,321	6	396,025
Total Project costs, Years 1 - 5	23,201,435	6,341,618	6,561,774	7,414,683	9,347,106	52,866,616	55	29,187,032	23,679,584	6	3,008,403

Source: Own calculations.

ANNEX 8
Table 51

Additional Funds Required for Support Measures

Expenditure item	Year 1 Costs	Year 2 Costs	Year 3 Costs	Year 4 Costs	Year 5 Costs	Total Years 1 - 5 Total cost	Foreign exchange costs		Local costs	Taxes & duties Foreign exchange costs	
	In LS						%	In LS		%	In LS
Investment costs											
Irrigation system	23,800	18,000	17,000	18,000	18,000	94,800	61	57,460	37,340	25	22,765
Agricultural production	2,632,400	1,697,100	1,750,100	1,981,600	1,994,700	10,055,900	80	8,044,720	2,011,180	5	502,795
Organization, management and training	687,585	-	-	89,000	399,400	1,175,985	63	739,747	436,238	23	274,331
Co-operative sector	56,550	21,850	2,300	22,300	23,200	126,200	65	82,130	44,070	17	20,825
General buildings	310,000	310,000	-	-	-	620,000	75	465,000	155,000	15	93,000
Total investment costs	3,710,335	2,046,950	1,769,400	2,110,900	2,435,300	12,072,885	78	9,389,057	2,683,828	8	913,716
Operating costs											
Irrigation system	21,120	39,900	57,648	55,332	55,332	229,332	24	55,380	173,952	2	4,260
Agricultural production	412,600	456,700	502,600	555,700	607,900	2,535,500		-	2,535,500		-
Organization, management and training	568,304	564,812	482,812	359,812	359,812	2,335,552	66	1,549,441	786,111	3	63,349
Co-operative sector	24,705	101,205	113,005	119,405	132,605	490,925	7	34,380	456,545	1	2,883
General buildings	-	6,200	12,400	12,400	12,400	43,400	55	23,870	19,530	10	4,340
Total operating costs	1,026,729	1,168,817	1,168,465	1,102,649	1,168,049	5,634,709	30	1,663,071	3,971,638	1	74,832
Total baseline costs	4,737,064	3,215,767	2,937,865	3,213,549	3,603,349	17,707,594	62	11,052,128	6,655,466	6	988,548
Physical contingencies (10 per cent)	473,706	321,577	293,787	321,355	360,335	1,770,760	62	1,105,213	665,547	6	98,855
Total incl. physical contingencies	5,210,770	3,537,344	3,231,652	3,534,904	3,963,684	19,478,354	62	12,157,341	7,321,013	6	1,087,403
Financial contingencies (10 per cent annually)	521,077	742,842	1,069,677	1,640,549	2,419,829	6,393,974	62	3,990,775	2,403,199	6	356,951
Additional funds required for Support Measures	5,731,847	4,280,186	4,301,329	5,175,453	6,383,513	25,872,328	62	16,148,116	9,724,212	6	1,444,354
Additional funds required for Livestock Component	2,017,092	1,279,369	1,260,079	1,025,552	1,568,236	7,150,328	28	2,001,007	5,149,321	6	396,025
Total funds required, years 1 - 5	7,748,939	5,559,555	5,561,408	6,201,005	7,951,749	33,022,656	55	18,149,123	14,873,533	6	1,840,379

ANNEX 8
Table 52

Comparison of Yields Estimates
(in KG/Feddan)

Project year	Cotton		Groundnuts	
	Phase I	Appraisal Report	Phase I	Appraisal Report
1	540	500	640	700
2	567	600	752	800
3	594	900	784	1,100
4	621	900	816	1,200
5	675	1,000	816	1,300

Sources: AHT: New Halfa Rehabilitation Project. Phase I. Essen 1978, ANNEX 21, Table 2, p.5.
WORLD BANK: New Halfa Irrigation Rehabilitation Project. Staff Appraisal Report No. 2608a - SU. Washington 1980, Table 6, p. 40.

ANNEX 8
Table 53

Crop Production Development without Support Measures

Year	Cotton			Groundnuts			Grain sorghum		
	Acreage (feddan)	Yield (t/fed.)	Production (in tons)	Acreage (feddan)	Yield (t/fed.)	Production (in tons)	Acreage (feddan)	Yield (t/fed.)	Production (in tons)
1	57,331	0.500	28,666	55,682	0.680	37,864	41,527	0.400	16,611
2	54,193	0.567	30,728	51,974	0.752	39,084	43,742	0.400	17,497
3	52,406	0.594	31,129	49,861	0.784	39,091	48,139	0.400	19,256
4	50,685	0.621	31,475	47,827	0.816	39,027	53,519	0.400	21,408
5	48,963	0.675	33,050	45,792	0.816	37,367	59,888	0.400	23,955
6	47,255	0.675	31,897	43,774	0.816	35,720	65,910	0.400	23,364
7	45,146	0.675	30,474	41,281	0.816	33,685	71,933	0.400	28,773
8	43,072	0.675	29,074	38,830	0.816	31,685	77,955	0.400	31,182
9	41,001	0.675	27,676	36,383	0.816	29,689	83,978	0.400	33,591
10	38,930	0.675	26,278	33,935	0.816	27,691	90,000	0.400	36,000
11	36,898	0.675	24,906	31,534	0.816	25,732	90,000	0.400	36,000
12	34,851	0.675	23,525	29,115	0.816	23,758	90,000	0.400	36,000
13	32,855	0.675	22,177	26,756	0.816	21,833	90,000	0.400	36,000
14	30,824	0.675	20,806	24,356	0.816	19,874	90,000	0.400	36,000
15	28,843	0.675	19,469	22,014	0.816	17,964	90,000	0.400	36,000
16	26,856	0.675	18,128	19,666	0.816	16,048	90,000	0.400	36,000
17	24,757	0.675	16,711	17,185	0.816	14,023	90,000	0.400	36,000
18	23,773	0.675	16,047	16,023	0.816	13,075	90,000	0.400	36,000
19	22,777	0.675	15,375	14,846	0.816	12,114	90,000	0.400	36,000
20	21,778	0.675	14,700	13,665	0.816	11,150	90,000	0.400	36,000
21	20,802	0.675	14,041	12,511	0.816	10,209	90,000	0.400	36,000
22	19,586	0.675	13,220	11,074	0.816	9,036	90,000	0.400	36,000
23	18,249	0.675	12,318	9,494	0.816	7,747	90,000	0.400	36,000
24	16,909	0.675	11,414	7,911	0.816	6,455	90,000	0.400	36,000
25	15,577	0.675	10,515	6,337	0.816	5,171	90,000	0.400	36,000
26	14,230	0.675	9,605	4,744	0.816	3,871	90,000	0.400	36,000
27	12,896	0.675	8,705	3,168	0.816	2,585	90,000	0.400	36,000
28	11,469	0.675	7,742	1,481	0.816	1,209	90,000	0.400	36,000
29	9,390	0.675	6,338	-	-	-	90,000	0.400	36,000
30	5,874	0.675	3,965	-	-	-	90,000	0.400	36,000

Source: ANNEX 2, Appendix B, and Table 39 of this ANNEX.

ANNEX 8
Table 54

Economic Value of Crop Production without Support Measures

Year	Seed cotton	Groundnut	Grain sorghum	Total
		in LS 1,000		
1	21,548	10,572	3,134	35,254
2	23,098	10,912	3,301	37,311
3	23,400	10,914	3,633	37,947
4	23,660	10,896	4,040	38,596
5	24,844	10,433	4,521	39,798
6	23,977	9,973	4,975	38,925
7	22,907	9,405	5,429	37,741
8	21,855	8,847	5,884	36,586
9	20,804	8,289	6,339	35,432
10	19,753	7,731	6,793	34,277
11	18,722	7,184	6,793	32,699
12	17,684	6,633	6,793	31,110
13	16,671	6,096	6,793	29,560
14	15,640	5,549	6,793	27,982
15	14,635	5,015	6,793	26,443
16	13,627	4,481	6,793	24,901
17	12,562	3,915	6,793	23,270
18	12,063	3,650	6,793	22,506
19	11,557	3,382	6,793	21,732
20	11,050	3,113	6,793	20,956
21	10,555	2,850	6,793	20,198
22	9,938	2,523	6,793	19,254
23	9,259	2,163	6,793	18,215
24	8,580	1,802	6,793	17,175
25	7,904	1,444	6,793	16,141
26	7,220	1,081	6,793	15,094
27	6,543	722	6,793	14,058
28	5,819	337	6,793	12,949
29	4,765	-	6,793	11,558
30	2,980	-	6,793	9,773

Source: Table 53 of this ANNEX.

ANNEX 8
Table 55

Economic Value of Incremental Crop Production

Year	With Support Measures					Without Support Measures	Incremental crop production benefits
	Seed cotton	Groundnuts	Grain sorghum	Fodder sorghum	Total		
	In LS 1,000						
1	23,399	11,594	1,197	1,937	38,127	35,245	2,873
2	26,289	12,840	1,122	2,179	42,430	37,311	5,119
3	27,813	14,019	1,115	2,518	45,465	37,947	7,518
4	30,966	15,306	1,333	2,707	50,312	38,596	11,716
5	33,804	16,721	1,548	2,973	55,046	39,798	15,248
6	35,697	17,490	1,698	3,277	58,162	38,925	19,237
7	36,839	17,863	1,772	3,697	60,131	37,741	22,390
8	37,208	17,904	1,806	4,078	60,996	36,586	24,410
9	36,736	17,496	2,199	4,140	60,571	35,432	25,139
10	35,778	17,288	2,403	4,390	59,859	34,277	25,582
11	34,743	16,496	2,355	4,438	58,032	32,699	25,333
12	33,612	16,176	2,290	4,503	56,581	31,110	25,471
13	32,368	15,339	2,228	4,565	54,500	29,560	24,940
14	31,047	14,667	2,197	4,596	52,507	27,982	24,525
15	29,660	13,853	2,168	4,625	50,306	26,443	23,863
16	28,108	12,866	2,146	4,647	47,767	24,901	22,866
17	26,324	11,690	2,146	4,647	44,807	23,270	21,537
18	25,634	11,560	2,146	4,647	43,987	22,506	21,481
19	24,776	10,733	2,146	4,647	42,302	21,732	20,570
20	23,870	10,120	2,146	4,647	40,783	20,956	19,827
21	22,971	9,490	2,146	4,647	39,254	20,198	19,056
22	21,622	8,493	2,146	4,647	36,908	19,254	17,654
23	20,255	7,451	2,146	4,647	34,499	18,215	16,284
24	18,863	6,362	2,146	4,647	32,018	17,175	14,843
25	17,415	5,186	2,146	4,647	29,394	16,141	13,253
26	15,860	3,894	2,146	4,647	26,547	15,094	11,453
27	14,243	2,604	2,146	4,647	23,640	14,058	9,582
28	12,522	1,230	2,146	4,647	20,545	12,949	7,596
29	10,089	-	2,146	4,647	16,882	11,558	5,324
30	6,314	-	2,146	4,647	13,107	9,773	3,334

Source: Tables 22 and 54 of this ANNEX.

ANNEX 8
Table 56

Economic Agricultural Production Costs without Support Measures

Year	Cotton	Groundnuts	Grain sorghum	Total
			In LS 1,000	
1	5,805	2,642	492	8,939
2	5,567	2,535	518	8,620
3	5,574	2,394	570	8,538
4	5,432	2,317	634	8,383
5	5,327	2,218	709	8,254
6	5,141	2,120	780	8,041
7	4,912	2,000	852	7,764
8	4,686	1,881	923	7,490
9	4,461	1,762	994	7,217
10	4,236	1,644	1,066	6,946
11	4,014	1,528	1,066	6,608
12	3,792	1,410	1,066	6,268
13	3,575	1,296	1,066	5,937
14	3,354	1,180	1,066	5,600
15	3,138	1,066	1,066	5,270
16	2,922	953	1,066	4,941
17	2,694	832	1,066	4,592
18	2,587	776	1,066	4,429
19	2,478	719	1,066	4,263
20	2,369	662	1,066	4,097
21	2,263	606	1,066	3,935
22	2,131	536	1,066	3,733
23	1,985	460	1,066	3,511
24	1,840	383	1,066	3,289
25	1,695	307	1,066	3,068
26	1,548	230	1,066	2,844
27	1,403	153	1,066	2,622
28	1,248	72	1,066	2,386
29	1,022	-	1,066	2,088
30	639	-	1,066	1,705

Source: Tables 39, 41, 43 and 53 of this ANNEX.

ANNEX 8
Table 57

Economic Agricultural Production Costs with Support Measures

Year	Cotton	Groundnuts	Grain sorghum	Total	Total without Project	Incremental production costs
	In LS 1,000					
1	6,401	2,738	502	9,641	8,939	702
2	6,369	2,685	529	9,583	8,620	963
3	6,504	2,739	582	9,825	8,538	1,287
4	6,712	2,824	648	10,184	8,383	1,801
5	7,007	2,950	725	10,682	8,254	2,428
6	7,578	3,011	798	11,387	8,041	3,346
7	7,490	2,946	870	11,306	7,764	3,542
8	7,289	2,829	943	11,061	7,490	3,571
9	6,964	2,653	1,016	10,633	7,217	3,416
10	6,608	2,477	1,089	10,174	6,946	3,228
11	6,253	2,302	1,089	9,644	6,608	3,036
12	5,900	2,127	1,089	9,116	6,268	2,848
13	5,548	1,953	1,089	8,590	5,937	2,653
14	5,198	1,780	1,089	8,067	5,600	2,467
15	4,851	1,609	1,089	7,549	5,270	2,279
16	4,508	1,439	1,089	7,036	4,941	2,095
17	4,162	1,268	1,089	6,519	4,592	1,927
18	4,012	1,194	1,089	6,295	4,429	1,866
19	3,838	1,108	1,089	6,035	4,263	1,772
20	3,660	1,020	1,089	5,769	4,097	1,672
21	3,487	935	1,089	5,511	3,935	1,576
22	3,248	817	1,089	5,154	3,733	1,421
23	3,011	700	1,089	4,800	3,511	1,289
24	2,777	584	1,089	4,450	3,289	1,161
25	2,539	466	1,089	4,094	3,068	1,026
26	2,304	350	1,089	3,743	2,844	899
27	2,069	234	1,089	3,392	2,622	770
28	1,819	111	1,089	3,019	2,386	633
29	1,466	-	1,089	2,555	2,088	467
30	917	-	1,089	2,006	1,705	301

Source: Tables 22, 40, 42, 43 and 56 of this ANNEX.

ANNEX 8
Table 60

Economic Costs of Combined Support and Livestock Measures, RWS

Year	Support Measures			Livestock component, RWS			Combined Measures, RWS	
	Investment	Operational	Total	Investment	Operational	Total	Total	Total plus 10% physical contingencies
	Costs in LS 1,000							
1	7,078	2,422	9,500	2,356	724	3,080	12,580	13,838
2	4,015	2,874	6,889	552	1,121	1,673	8,562	9,410
3	3,516	3,179	6,695	789	1,404	2,193	8,888	9,777
4	4,150	3,546	7,696	573	1,598	2,171	9,867	10,854
5	4,676	4,269	8,945	940	1,802	2,742	7,011	7,712
6	224	5,070	5,294	1,126	2,025	3,151	8,445	9,290
7	659	5,297	5,956	1,068	2,316	3,384	9,340	10,274
8	501	5,360	5,861	1,092	2,614	3,706	9,567	10,524
9	1,203	5,209	6,412	634	2,727	3,361	9,773	10,750
10	1,122	4,943	6,065	796	3,012	3,808	9,373	10,860
11	2,430	4,755	7,185	1,389	3,094	4,483	11,668	12,835
12	733	4,571	5,304	835	3,224	4,059	9,363	10,299
13	1,845	4,381	6,226	1,465	3,337	4,802	11,028	12,131
14	3,147	4,198	7,345	600	3,433	4,033	11,378	12,516
15	2,531	4,013	6,544	1,384	3,519	4,903	11,447	12,592
16	2,720	3,771	6,491	1,346	3,619	4,965	11,456	12,602
17	1,663	3,562	5,225	1,321	3,662	4,983	10,208	11,229
18	144	3,442	3,586	1,112	3,712	4,824	8,410	9,251
19	661	3,348	4,009	474	3,776	4,250	8,259	9,085
20	366	3,248	3,614	709	3,797	4,506	8,120	8,932
21	2,666	3,067	5,733	1,894	3,816	5,710	11,443	12,587
22	652	2,912	3,564	1,000	3,880	4,880	8,444	9,288
23	35	2,780	2,815	1,132	3,924	5,056	7,871	8,658
24	33	2,652	2,685	677	3,941	4,618	7,303	8,033
25	1,157	2,517	3,674	1,942	3,961	5,903	9,577	10,534
26	1,363	2,305	3,668	1,701	3,968	5,669	9,337	10,271
27	2,905	2,176	5,081	1,013	3,965	4,978	10,059	11,065
28	2,340	1,987	4,327	1,236	3,963	5,199	9,526	10,479
29	728	1,803	2,531	1,924	3,960	5,884	8,415	9,257
30	-	1,637	1,637	-	3,960	3,960	5,597	6,157

Source: Volume II, Table 99 and Table 58 of this ANNEX.

ANNEX 8
Table 61

Foreign Exchange Component Costs of Support Measures

Year	Investment costs					Total investment costs	Operating costs					Total operating costs	Total costs	Total costs
	Irrigation	Agricultural machinery	Co-operative sector	Organization, management and training	General buildings		Irrigation	Agricultural production	Co-operative sector	Organization, management and training	General buildings			
	In LS 1,000													In US$ 1,000
1	16	2,106	60	420	233	2,835	10	524	4	375	3	916	3,751	7,502
2	12	1,358	17	-	233	1,620	18	596	15	373	6	1,008	2,628	5,256
3	11	1,400	2	-	-	1,413	26	523	17	319	6	891	2,304	4,608
4	12	1,585	12	58	-	1,667	25	667	18	237	6	953	2,620	5,240
5	12	1,596	16	260	-	1,884	25	840	20	237	6	1,128	3,012	6,024
6	12	78	-	-	-	90	25	921	20	163	6	1,135	1,225	2,450
7	12	195	-	58	-	265	25	964	20	163	6	1,178	1,443	2,886
8	12	189	-	-	-	201	25	968	20	163	6	1,182	1,383	2,766
9	11	204	12	260	-	487	25	926	20	163	6	1,140	1,627	3,254
10	12	382	-	58	-	452	25	879	20	163	6	1,093	1,545	3,090
11	13	907	38	19	-	977	25	828	20	163	6	1,042	2,019	4,038
12	11	267	17	-	-	295	25	779	20	163	6	993	1,288	2,576
13	12	402	14	317	-	745	25	726	20	163	6	940	1,685	3,370
14	12	1,251	2	-	-	1,265	25	676	20	163	6	890	2,155	4,310
15	11	1,002	4	-	-	1,017	25	628	20	163	6	842	1,859	3,718
16	13	1,023	-	58	-	1,094	25	578	20	163	6	792	1,886	3,772
17	12	388	12	260	-	672	25	532	20	163	6	746	1,418	2,836
18	11	46	-	-	-	57	25	514	20	164	6	728	785	1,570
19	12	196	-	58	-	266	25	490	20	163	6	704	970	1,940
20	12	115	-	19	-	146	25	464	20	163	6	678	824	1,648
21	12	754	50	260	-	1,076	25	438	20	163	6	652	1,728	3,456
22	12	176	17	58	-	263	25	398	20	163	6	612	875	1,750
23	12	-	2	-	-	14	25	364	20	163	6	578	592	1,184
24	11	-	2	-	-	13	25	331	20	163	6	545	558	1,116
25	12	124	16	317	-	469	25	295	20	163	6	509	978	1,956
26	13	194	10	84	233	534	25	261	20	163	6	475	1,009	2,018
27	11	929	-	-	233	1,173	25	227	20	163	6	441	1,614	3,228
28	12	871	-	58	-	941	25	189	20	163	6	403	1,344	2,688
29	12	-	22	260	-	294	25	147	20	163	6	361	655	1,310
30	-	-	-	-	-	-	25	105	20	163	6	319	319	638

Source: Tables 39 - 49 of this ANNEX.

ANNEX 8
Table 62

Foreign Exchange Earnings of Combined Support and Livestock Measures, RWS

Year	Value of incremental cotton production	Value of incremental groundnut production	Value of incremental grain sorghum production	Value of incremental crop production	Value of livestock production	Total value of incremental Project production	Foreign exchange costs of crop production	Foreign exchange costs of livestock production	Total foreign exchange costs	Annual net foreign exchange earnings	Cumulative net foreign exchange earnings
						In US$ 1,000					
1	1,705	1,233	- 2,001	937	377	1,314	7,502	2,078	9,580	- 8,266	- 8,266
2	2,939	2,325	- 2,250	3,014	2,956	5,970	5,256	1,500	6,756	- 786	- 9,052
3	4,065	3,744	- 2,601	5,208	3,615	14,793	4,608	1,810	6,418	8,375	- 677
4	6,730	5,318	- 2,795	9,253	4,780	14,033	5,240	1,862	7,102	6,931	6,254
5	8,253	7,584	- 3,069	12,768	5,157	17,925	6,024	2,212	8,236	9,689	15,943
6	10,795	9,065	- 3,384	16,476	5,938	22,414	2,450	2,322	4,772	17,642	33,585
7	12,832	10,201	- 3,777	19,256	6,921	26,177	2,886	2,546	5,432	20,745	54,330
8	14,141	10,924	- 4,211	20,854	8,385	29,239	2,766	2,700	5,466	23,773	78,103
9	14,674	11,103	- 4,275	21,502	9,393	30,895	3,254	2,762	6,016	24,879	102,982
10	14,760	11,526	- 4,534	21,752	9,715	31,467	3,090	2,922	6,012	25,455	128,437
11	14,756	11,230	- 4,583	21,403	11,028	32,431	4,038	3,156	7,194	25,237	153,674
12	14,671	11,509	- 4,650	21,530	11,279	32,809	2,576	3,028	5,604	27,205	180,879
13	14,459	11,147	- 4,714	20,892	11,622	32,514	3,370	3,474	6,844	25,670	206,549
14	14,191	10,997	- 4,746	20,442	11,946	32,388	4,310	3,084	7,394	24,994	231,543
15	13,839	10,658	- 4,776	19,721	12,107	31,828	3,718	3,188	6,906	24,922	256,465
16	13,338	10,113	- 4,799	18,652	12,263	30,915	3,772	3,500	7,272	23,643	280,108
17	12,676	9,376	- 4,799	17,253	12,378	29,631	2,836	3,584	6,420	23,211	303,319
18	12,500	9,539	- 4,799	17,240	12,378	29,618	1,570	3,392	4,962	24,656	327,975
19	12,175	8,865	- 4,799	16,241	12,378	28,619	1,940	3,278	5,218	23,401	351,376
20	11,808	8,451	- 4,799	15,460	12,378	27,838	1,648	3,306	4,954	22,884	374,260
21	11,437	8,007	- 4,799	14,645	12,378	27,023	3,456	3,920	7,376	19,647	393,907
22	10,762	7,200	- 4,799	13,163	12,378	25,541	1,750	3,506	5,256	20,285	414,192
23	10,128	6,377	- 4,799	11,706	12,378	24,084	1,184	3,548	4,732	19,352	433,544
24	9,471	5,499	- 4,799	10,171	12,378	22,549	1,116	3,410	4,526	18,023	451,467
25	8,760	4,513	- 4,799	8,474	12,378	20,852	1,956	3,758	5,714	15,138	466,705
26	7,958	3,393	- 4,799	6,552	12,378	18,930	2,018	3,932	5,950	12,980	479,685
27	7,092	2,270	- 4,799	4,563	12,378	16,941	3,228	3,518	6,746	10,195	489,880
28	6,173	1,076	- 4,799	2,450	12,378	14,828	2,688	3,612	6,300	8,528	498,408
29	4,905	-	- 4,799	106	12,378	12,484	1,310	3,528	4,838	7,646	506,054
30	3,071	-	- 4,799	-1,728	12,378	10,650	638	3,106	3,744	6,906	512,960

Source: Tables 22, 39-44 and 53 of this ANNEX.

1. Income of the Halfawyeen Tenant

1.1 General

It has been found that the main sources of the tenants' income in the Halfawyeen area are the returns from the following enterprises:

- the cultivation of the three crops: cotton, groundnuts, and wheat
- the farming of the "amlak" (freehold) land
- the sales of livestock, and livestock products
- employment in off-farm occupations i.e. government plus private sectors
- other sources of income mainly remittances, profit deriving from trade, and renting of houses.

1.2 Income from Crop Production

Despite the declining agricultural situation of the Scheme, the Halfawyeens have, compared to the Nomads, managed to continue growing the three crops: cotton, groundnuts and wheat. They have been aided in this by the farm-machinery co-operatives developed at the level of nearly all of the Halfawyeen villages, the cash sent home by absent tenants, the readily available agents (relatives) in all villages who cultivate for those who are absent, and the system of cultivation on credit adopted by some of the co-operatives.

The net result of the above advantages is that most of the Halfawyeen tenancies are annually put under the three crops, irrespective of what yields are attained. The data from the case studies substantiate the above picture. The average income raised by those tenants in the sample, growing each of the three crops, was LS -28 from cotton, LS 67 from groundnuts, and LS 27 from wheat, giving a total of LS 66.

There is evidence indicating that these figures are close to reality for an average tenant in the Halfawyeen area. To start with, it is only normal that tenants in both of the Halfawyeen and the Nomad areas usually do not regularly receive any annual returns from cotton. Even when the joint account is settled every 2 - 3 years, the majority of tenants emerge indebted on cotton. Hence the negative figures of LS -28, as paid from the tenants' own resources, does not seem unrealistic.

The LS 84 as an average income from groundnuts seem to be true for an average tenant. This is not the case for all of the Halfawyeen tenants, since those wholly managing production by themselves (not on share cropping basis) could raise up to LS 400 from groundnuts. This latter category accounts for an estimated 30 per cent of all of the Halfawyeen tenants.

Again, the figure of LS 27 for wheat seems to be an reasonable income for this crop, taking into consideration that one of the cases studies had a total crop failure, registering a loss of LS 128. A good part of the wheat produced (in the order of 8 sacks) is kept in the family store to meet its annual food requirements, while the surplus is sold for cash. The income from wheat are the transferred cash values of all the amounts produced by the tenant.

In addition to the income raised from the tenancy there is that earned from the "amlak" land. The average income earned per tenant is LS 116, normally attained through the cultivation of a number of vegetable crops, through share-cropping or through direct renting of the land.

No income is obtained from dura, since this crop is not produced in the Halfawyeen area.

1.3 Income from Livestock

Most of the cases surveyed earned incomes from livestock raising, mainly the sale of of-spring and milk products. This emphasizes the fact that the Halfawyeen tenant has taken up livestock raising as a subsidiary source of income, and validates the remark made by many respondents that "We discovered recently that livestock raising is more profitable than agriculture". The average income is LS 97 as compared to LS 76 from the three crops, and LS 116 from the "amlak" land demonstrates clearly this emergent economic role of livestock, as compared to agriculture, under present Scheme conditions.

1.4 Income from Employment plus Other Sources

Most of the respondents have occupations other than agriculture. This confirms the fact that with the rise of the Scheme, the emergence of New Halfa Town, the development of service facilities in the Halfawyeen settlements, and the establishment of private business, off-farm employment opportunities have been widely created in almost all of the Halfawyeen area. The result of these opportunities has been that the Halfawyeen tenant has managed to integrate his involvement in the tenancy (mostly through the use of wage labour) with off-farm employment in the government or the private sector.

2. Income of the Nomad Tenant

2.1 General

The same sources of income listed previously for the Halfawyeen tenant hold true for the Nomad tenant with the exception of the following variations:

- Nomad tenants do not possess "amlak" land, hence there is no income under this heading.
- Being dura cultivators prior to their resettlement in the Scheme, dura cultivation emerges as a source of income in the Nomad area, grown mainly outside the Scheme, and recently inside the Scheme.

2.2 Income from Crop Production

Compared to the Halfawyeen area, the Nomad tenants have not cultivated regularly during the last two production years. Among the three crops, cotton is the one grown by nearly all tenants in the Nomad area while groundnuts and wheat are cultivated by a lesser number of tenants. The explanation for this variation is to be found in the fact that cotton is the government crop which guarantees the right of the tenant to the tenancy; while both the groundnut and the wheat crops entail inputs which are not available to most of the Nomad tenants. Further, the practice of share-cropping of tenancies with migrant labour in case of groundnut which is widely applied in the Halfawyeen area, is not yet diffused on a large scale in the Nomad area, partly because the limited financial means of the tenant prevent him from supporting share-croppers during the production season.

Compared to the previous figures for the Halfawyeen tenant the average income earned by a Nomad tenant, is LS -4 from cotton, LS 15 from groundnuts, and LS 31 from wheat. It was observed that while the Halfawyeen tenant registers a loss of LS 28 on cotton, the Nomad tenant reach only a loss of LS 4 from the same crop. This is explained by the fact that many of the Nomad tenants, contrary to the Halfawyeen, do not employ labour for most of the stages in growing cotton, thus benefiting from the loans for this crop as a source of income.

The average income derived by these tenants cultivating groundnuts LS 15 per tenant which is a very low figure compared to the Halfawyeen area (LS 67) or to the income earned by a migrant labour share-cropper (LS 119), as indicated later.

The wheat growing tenants earn an average income of LS 31 from this crop in the Nomad area, as compared to LS 27 in the Halfawyeen area.

Overall, the Nomad tenant earns LS 42 from the three crops, in comparison to LS 66 (average over all tenants) raised by the Halfawyeen.

As for his earnings from dura, the average per tenant amounts to LS 43; hence raising his total income from crop production to LS 85, compared to LS 182 made by the Halfawyeen tenant from the cultivation of the three crops plus the "amlak" land.

2.3 Income from Livestock

Most of the Nomad tenants claim that they sell their livestock to finance agricultural operations, support their families, and to purchase fodder to enable the rest of their herds to survive. Hence, it is only normal that the Nomad tenant derives much of his income from livestock breeding.

The average earning per tenant from selling livestock amounts to LS 154, as compared to LS 97 in the Halfawyeen case.

2.4 Income from Employment plus Other Sources

In opportunities for permanent employment, the Nomad tenant is at a disadvantage relative to the Halfawyeen, being remote from New Halfa Town, coupled with the under-developed situation of the centres of service in his own area.

In the samples surveyed, about 40 per cent of the tenants, besides farming, undertook employment as labourers on a temporary basis, seeking work in the tenancies of other farmers. An average income of LS 48 has been identified as earnings from employment fo the tenant in the Nomad area. Compared to the Halfawyeen tenant, the latter's average income of LS 582 from the same source demonstrates the gap between the two parts of the Scheme.

As for other sources of income, in the Nomads' case these are mainly remittances sent home by relatives or the profit raised from trade. Again the Nomad tenant is at a disadvantage in this respect compared to the Halfawyeen tenant who receives LS 157 from this source.

Finally, the total income of the Nomad tenant, from all of the above sources, amounts to LS 369, with 11.4 per cent raised from the cultivation of the three crops, 11.7 per cent from dura production, 42.0 per cent from livestock, and 34.9 per cent from employment plus other sources of income. Again compared to the average income of the Halfawyeen tenant of LS 1,018, this clearly demonstrates the gap separating the two communities.

3.2 Income from Crop Production

Of the three crops, the most remunerative to Migrant Labour, in both the Halfawyeen and the Nomad areas, is groundnuts. The average income from groundnuts comes to LS 218 per Migrant Labour.

Cotton comes next to groundnuts as an income earning crop to the Migrant Labour. In fact in recent years, many tenants in both the Halfawyeen and the Nomad areas have begun to impose, as a pre-condition to the release of their tenancies for groundnuts share-cropping, the acceptance of responsibility for the stages of growing cotton on the tenancy. It seems that this arrangement is working, since many Migrants mention that they "are share-cropping cotton". Against this arrangement the Migrant will get credit facilities in the village shop, guaranteed by the owner of the tenancy.

The income raised by the Migrant from cotton is composed mainly of the loans given for the different agricultural operations plus what the Migrant and his family manage to earn from the picking operation. An average income of LS 116 from this crop is reached.

Wheat is the crop contributing least to the income of Migrant Labour; mainly due to the limited number of operations requiring employment of labour i.e. only watering and light weeding. The average comes to LS 27 per Migrant.

Based on the above averages, a Migrant Labourer makes an income of LS 361 from the three crops, [illegible]st LS 66 made by the Halfawyeen tenant, and LS 42 by the Nomad tenant from the cultivation of the same crops.

Apart from the three crops, Migrants also derive income from "amlak" land in the Halfawyeen area either through selling their labour, or through share-cropping arrangements, or through direct management of production on rented land. The Migrants deriving income from "amlak" land did so on a sharing cropping basis, making an average of LS 38 in the Halfawyeen area.

In the Nomad area, Migrants raise incomes from working in dura cultivation. Most of them obtained income from this activity

3.3 Income from Livestock

A good number of the Migrant Labourers keep livestock, mainly sheep and goats, and some also keep cattle. The income from the selling of livestock amounts to an average of LS 25. Added to the previous income derived from crop production, this brings the total figure to LS 445; against LS 279 and LS 239, raised by the Halfawyeen and the Nomad tenants respectively, from total crop production and livestock raising.

3.4 Income from Employment plus Other Sources

Migrant Labour of recent origin in the Scheme area, does not derive income from employment in government enterprises.

As for income generated by Migrant Labour from sources other than government and private sector employment i.e. house construction, selling of straw, sesame harvesting in Gedaref area, etc., this is found to be an average of LS 67 per Migrant.

Based on the above computations, the income of the Migrant Labour from all of his economic activities in the Scheme comes to LS 522, compared to a total income of LS 1,018 for the Halfawyeen tenant, and LS 367 for the Nomad tenant.

3.5 Expenditure of Migrant Labour

The expenditure of the Migrant Labour follows the same pattern as that of the Halfawyeen and the Nomad tenants, with the exception that it tends to be lower in money value transactions. Again, the highest item of expenditure is on food: 77.3 per cent, compared to 80.3 per cent, and 86.9 per cent of all family expenditure for the Halfawyeen and the Nomad tenants respectively. LS 289 is spend on food in an average.

The other items of expenditure assume the following percentages: clothes 5.7 per cent, social obligations 5.4 per cent, medical treatment 1.7 per cent, and 9.9 per cent for other items.