



ARDRI



TAUNG IRRIGATION SCHEME
University of Fort Hare
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REDEVELOPMENT PLANNING

IV: MODEL FOR RESTRUCTURING

THE AGRICULTURAL AND RURAL DEVELOPMENT RESEARCH INSTITUTE

UNIVERSITY OF FORT HARE

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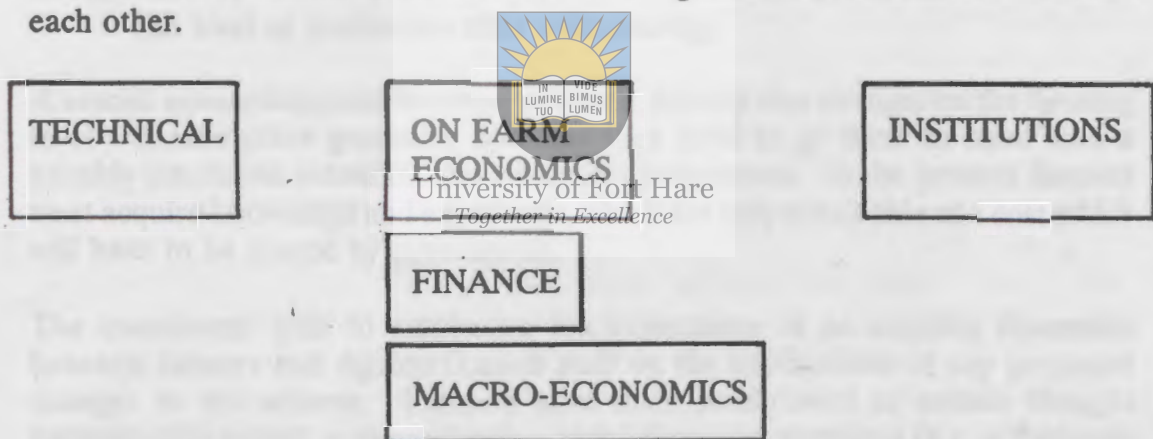
IV: MODEL FOR RESTRUCTURING

1. INTRODUCTION

The second and third ARDRI reports "Situation Analysis" and "Alternative scenarios and restructuring proposals" contains the motivation for the model elucidated in this report. Some of the financial and other implications of the models are fully discussed in these reports.

In this report a basic model is proposed, in which certain concepts are considered fixed while other variables allow for the flexibility needed to accommodate the varied skills, abilities and interests of human beings.

The model is conceived in terms of the following modules, which interrelate with each other.



It is clear from the situation analysis and restructuring proposals that substantial changes have to be made to move from the present system to the one that is required. The challenge is to make the transition over the shortest possible time span which will be executable by and acceptable to all participants.

As a result of the participative way in which the whole investigation was done, some of the proposals have already being implemented. Others have been initiated by the Interim Management Board.

1.1. Consensus issues

All the roleplayers on the scheme agree that after restructuring

- The land will be used for agricultural production by individual farmers.
- Farmers will be responsible for their own success or failure. Both decision-making and accountability will have been transferred to the

farmers.

- A land market will exist on the scheme. Tenure will be tradeable, whatever form it takes.
- Diverse production systems will exist, reflecting the difference in aptitude and interest of the farmers.

1.2 Uncertainties

At this time uncertainty prevails about

- The minimum time needed to implement the change. Farmers have expressed a deeply felt sense of urgency about speedy implementation.
- The resolution of past debt.
- The price of land and to whom this should be paid.
- The level of production after restructuring.

A crucial assumption must however be stated, namely that changes on the farming level will take place gradually, and that they need to go hand in hand with a suitably structured extension and education programme. In the process farmers must acquire knowledge and experience, which are only obtainable at a cost which will have to be shared by government.

The consultants wish to emphasize the importance of an ongoing discussion between farmers and Agricor/Lesedi staff on the implications of any proposed changes to the scheme. Farmers have been conditioned to certain thought patterns with regard to dependencies, restrictions and aversions (e.g. a thorough distrust of Lesedi) and they need time to adjust to a new way of thinking about their own role and the role of Agricor, Agribank and a Co-operative.

2. TECHNICAL MODULE

2.1 Production systems

As far as the production system on the scheme is concerned, the message from the various workshops was very clear i.e. the farmer must be independent and make his own decisions as far as production is concerned, otherwise there is basically no scheme. It was very clearly stressed that

- The farmer wants to be responsible for the selection and production of the crop.

- The extension staff and Agricor should not be responsible for production.
- The farmer is responsible for his own choice of contractor.
- The farmer is responsible for the financing of the production loans.
- The farmer is responsible for the scheduling and the decision when and how to irrigate.
- The farmers do not really want a change in irrigation system.
- The farmer recognizes and accepts the responsibilities that goes hand in hand with the system of free choice.

To be able to operate within the above non-negotiable terms the different workshops suggested the following measures to help ease the scheme from an estate type of system towards a system where the individual farmer has the freedom of choice and also the associated responsibilities.

- Temporary production officers should be appointed for a maximum period of 5 years to facilitate the change-over to a self-motivated, self-reliant farmer. It was stressed that this officer should assist the farmer on a practical level i.e. when and which seed to order, when to plant, when to irrigate etc. The costs involved with this suggestion should be borne by the government or its agency.
- Although it is the farmers' prerogative to select the crops he wishes to grow, it is recommended that they continue to plant low-risk crops. The suggested crops are wheat, groundnuts, cotton and late maize as a catch crop. The production costs for these low-risk crops are summarized in the crop budget section. If a farmer wishes and can afford the growing of more expensive, high risk type of crop such as citrus, pecans or wine grapes, he must not be prevented to do so.
- It is recommended that the farmers use a crop rotation programme of groundnuts, wheat, maize, fallow and cotton. Producing maize at Taung involves a high risk of theft losses. So if maize is left out of the crop rotation programme it means the farmer will have no income for a whole year. To solve this problem it is recommended that a farmer divides the 10 ha field into three sections of 3,3 ha each. The crop rotation for each section is illustrated in Table 1.

Table 1 Crop rotation programme for each of three sections

Season	Section1	Section2	Section3
Summer	Groundnuts	Cotton	Maize
Winter	Wheat	Wheat	
Summer	Maize	Groundnuts	Cotton
Winter		Wheat	Wheat
Summer	Cotton	Maize	Groundnuts
Winter	Wheat		Wheat
Summer	Groundnuts	Cotton	Maize

This cropping system allows the farmer to grow 3,3 ha groundnuts, 3,3 ha cotton, 3,3 ha maize and 6,6 ha wheat each year thus providing a continuous cash flow, a distribution of risk and the levelling of the peak water demand of the crop. At target yields of 5,0 t/ha for wheat, 2 t/ha groundnuts, 3 t/ha cotton and 7 t/ha maize this system will provide the farmer with a nett annual income of R 8 194 for scenario (a) (see section on irrigation costs), R 4 891 for scenario (b), R 7 679 for scenario (c) R 7 032 for scenario (d) and R 6 449 for scenario (e). This option will require a high degree of dedication from the centre pivot farmers in terms of irrigation scheduling.

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- If a farmer is interested in incorporating livestock in his enterprise, he should be encouraged to do so as it should stabilize his income.
- If any farmer should be interested in growing vegetables, he must be free to do so. The new co-op should actually cater for such an eventuality and stock the necessary seed, pesticides and fertilizer.
- The BEWAB approach of a predetermined water application programme is recommended for irrigation scheduling. This programme makes provision for all the recommended crops and have been tested on Vaalharts. The proposed target yields are based on the assumption that irrigation will be scheduled to prevent unacceptable yield losses.
- Sustainable low risk cropping should result from these recommendations for dedicated farmers applying reasonably sound cultivation practices.

2.2 Mechanization

It was clear from the results of the workshop on mechanization that the following set of rules should cover this key element.

- The farmer must have an absolute free choice of contractor whether from the scheme or from outside the scheme. This means that the farmer can make his own arrangements with the contractor of his choice. The farmer can negotiate his own tariffs and payment with the contractor of his choice.
- The farmer must arrange the financing of the mechanized aspect of the crop on his own.

The following can be expected to result from this arrangement.

- Contractors will have to supply a better service as far as the tilling of the soil is concerned.
- Contractors will have to employ better trained operators or train their own operators to survive.
- It will open the door for farmers to buy their own equipment if so desired.

There was no feasible alternative found to the above mentioned model and this situation was regarded as non-negotiable. To the knowledge of the consultants these recommendations have already been implemented successfully during the 1991 wheat season. According to Mr Penny of Agrigor District Office the following system was introduced in respect of the winter wheat season during 1991.

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- A farmer selects his own contractor and negotiates the time and rates for the work to be done. The co-op then issue the contractor with an order for the work to be done at the specified rates. The contractor is then paid by the co-op after the work has been completed to the satisfaction and acceptance of the farmer.
- As far as harvesting was concerned, Agrigor and the co-op negotiated prices, the number of harvesters and schedule of availability with various contractors, and the farmers were then free to select any of the approved contractors.

According to Mr Penny, this system worked without any hitches and not a single problem arose during the cultivation season.

2.3 Irrigation systems

The workshop on irrigation systems was unanimous on the following matters.

- Farmers who farm under centre pivots want to continue this practice.
- Farmers at Mokassa who use sprinklers are happy with the existing system.

- Flood irrigation in any form was not even a consideration.

Because the centre pivots are in position and there is no system that can be installed at a cheaper cost than the present book value of the centre pivots, it seems logical to keep and maintain the present existing irrigation systems. For these systems to operate and be operated successfully, certain conditions will have to be met.

- All mobile pivots have to be converted to fixed pivots. This is already being done by Agricor.
- The maintenance of the pivots must be the responsibility of the owner (either Agricor or the participant farmers). The suggested rate to be paid to the agency for maintenance is R 120/ha. This includes only normal maintenance, any damage due to abnormal usage or vandalism should be for the account of the user.
- Agricor or the government agency should be responsible for the bulk water supply. As this is an international agreement, any problems with the supply must be sorted out between the governments involved. It is strongly suggested that a water quota be allocated to each property and it is proposed that this quantity be 9 500 m³/ha/annum. Measurement can be done through meters, pump hours or irrigation hours.

With the known technology at our disposal and considering factors such as type of soil, type of crop, size of land and available water, a farmer at Taung will have the following options in the selection of his irrigation system. These are not the only options but they seem to be the most realistic.

2.3.1 Centre pivot farmers

The centre pivot farmer can select any one of the following options

- Option 1 The farmer can retain the status quo and rent the pivot from Agricor.
- Option 2 The farmer(s) can buy the pivot from Agricor either cooperatively or buy one of the smaller 20 ha pivots outright. The pivot then becomes the property of the farmer(s) who will then be responsible for the maintenance and scheduling programmes.
- Option 3 The farmer can also opt to rent only the pump and main pipeline from Agricor (excluding the pivot) and buy his own sprinklers which can be in the form of hand move or dragline sprinklers or a side-roll system.
- Option 4 The farmer can buy his own pump, main line and sprinkler system.

Option 5 The farmer can buy his own pump and main line and convert to a flood irrigation system.

2.3.2 Mokassa farmers

The farmers presently at Mokassa have only two options i.e.

Option 1 Retain the status quo where the infrastructure is rented from Agricor and the distribution system belongs to the farmer. The distribution can be any sprinkler system and may even be a micro-irrigation system.

Option 2 The farmer can switch to flood irrigation. This will however require an energy-dissipator such as a dam as the water is delivered at a pressure head of approximately 23 meters.

2.3.3 Flood irrigation

Flood irrigation cannot be recommended because of the following

- to be able to manage a flood irrigation system, a very high degree of management skills are required.
- the soil-type does not lend itself to the design of a flood system because of the low clay content.
- flood irrigation in a block layout will lead to waterlogging and a subsequent need for drainage system for the irrigable soils. This is already a problem at Mokassa.
- application efficiency of a flood irrigation system under best management can only reach approximately 70% in comparison to 90% with a centre pivot. If a farmer is allocated the proposed 950 mm/ha/annum this converts to effectively 665 mm for crop production in the case of flood irrigation and 855 mm in the case of centre pivots. The corresponding figure for sprinkler irrigation is approximately 80%.

2.3.4 Centralised control

Serious consideration should be given to the possibility that Agricor control the centre pivot irrigation down to the starting and stopping of the implement i.e. centralize the water application. The farmer can still do the scheduling and apply for water on a weekly basis. This will alleviate the maintenance problem. The present system where the farmers are jointly and individually responsible for operation and maintenance, works well if the four farmers sharing a pivot can work together. Unfortunately this does not happen very often in practice.

3. ON FARM ECONOMICS

As a basis for the farm economic analysis two typical farming models were built, a 10 ha model for pivot farmers and a 7,5 ha model for sprinkler farmers. With these models the sensitivity to changes in crop rotation, production efficiency, water cost, land tenure systems and prices were investigated and the financial impact on net present value, benefit/cost ratio, internal rate of return, average yearly gross and retainable income recorded.

3.1 Cost of water

The cost of irrigation water is basically the cost of providing the water that is required to grow a crop successfully. The cost is made up of the following elements

- Water tax
- Energy cost
- Rental or owning cost of the equipment
- Maintenance of the equipment

The different irrigation cost scenarios are listed below. All the systems mentioned are appropriate as far as the crop-soil combination is concerned.

Pivot Farmers


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(a) Renting a pivot from Agricor

Water tax (See main report)	R 163-00
Pivot rental (See main report)	R 175-00
Pivot maintenance (See main report)	R 120-00
Electricity (See main report)	<u>R 125-00</u>
Total cost	R 583-00/ha/annum
Cost/crop	R 388-00/ha/annum

(b) Farmer owning a pivot (either cooperatively or on his own)

Water tax	R 163-00
Pivot (R. 2 000 @ 16% for 7 years)	R 500-00
Pivot maintenance	R 120-00
Electricity	<u>R 125-00</u>
Total cost	R 908-00/ha/annum
Cost/crop	R 605-00/ha/annum

This cost will be applicable for 7 years while he still pays for the pivot. Thereafter this becomes R408,00 total cost and R272,00 per crop/ha/annum.

(c) **Farmer renting pump and pipe on a rotational basis.**

Water tax	R 163-00
Renting pump and pipeline (R 300/ha @ 16% for 15 years)	R 54-00
Owning cost of his own distribution system (R 1 700/ha @ 16% for 7 years)	R 425-00
Electricity	R 125-00
Maintenance (estimated)	<u>R 30-00</u>
Total cost	R 797-00/ha/annum
Cost/crop	R 531-00/ha/annum

(d) **Farmer buying his own pipeline, pump and sprinkler equipment.**

Water tax	R 163-00
Owning cost of equipment (R 3 000/ha @ 16% for 7 years)	R 480-00
Maintenance	R 120-00
Electricity	<u>R 135-00</u>
Total cost	R 898-00/ha/annum
Cost/crop	R 600-00/ha/annum

This position will last for 7 years. After 7 years the total cost becomes R 418/ha/annum and the cost/crop becomes R 279/crop/annum

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(e) **Farmer buying his own pump and pipeline and converts to flood irrigation.**

Water tax	R 163-00
Electricity	R 60-00
Maintenance (Flood levelling)	R 110-00
Equipment(R6 000 @ 16% over 7 yrs)	R 90-00
Land levelling and canals (R 4 500/ha @ 8% over 25 years)	<u>R 400-00</u>
Total cost	R 823-00/ha/annum
Cost/crop	R 549-00/ha/annum

Mokassa farmers

The only reason why Mokassa farmers don't pay electricity is because the topography allows the sprinklers to be gravity driven.

(f) Sprinkler system at Mokassa

Water tax	R 163-00
Rental of infrastructure(See main report)	R 80-00
Owning cost of a distribution system (See c above)	R 425-00
Maintenance (estimated)	<u>R 30-00</u>
Total cost	R 698-00/ha/annum
Cost/crop	R 465-00/ha/annum

(g) Flood option at Mokassa

The cost of this option will be as calculated in the original report (Annexure A).

If the farmer is granted a loan at 8% interest the cost will be R 759/ha. This is made up as follows

Development cost	R 406-00
Maintenance cost	R 110-00
Rent of infrastructure	R 80-00
Water tax	<u>R 163-00</u>
Total cost	R 759-00/ha/annum
Cost/crop	R 506-00/ha/annum



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It must be stressed to the farmers that a high degree of skill and responsibility will be required to operate the proposed systems at Mokassa successfully. The institutions at Taung must ensure that the required level of technology-transfer is available if and when it is demanded by the participating farmers.

There is one other alternative option at Mokassa and that is to re-design the Mokassa-area and install centre pivots. This can however only be done if the farmers demand this drastic step.

3.2 Crop budgets

The adjusted crop budgets for scenario (a) is listed below.

GRONDBONE

	Eenh	Prys of koste/eenh	Hoev	Waarde per ha
1	Bruto inkomste uit produksie:			
	Ton	1 500	1,300	1 950,00
	Ton	653	0,700	457,10
	Ton	110	2,000	<u>220,00</u>
	Inkomste - Heffings (per ha):			<u>2 627,10</u>
2	Ge-allokeerde koste:			
	Voor-oes:			
	kg	1,740	120,000	208,80
	kg	21,400	0,300	6,42
	l	18,400	1,000	18,40
	l	50,000	0,500	30,00
				201,59
				400,00
				388,00
				<u>127,70</u>
	Totale voor-oeskoste per ha:			<u>1 480,91</u>
	Voor-oeskoste per ton:			<u>740,46</u>
	Oes:			
	sak	0,015	125,000	1,88
	sak	1,500	37,000	55,50
	ha	5,000	14,000	70,00
	ha	5,000	6,000	30,00
	ha	5,000	3,000	15,00
	baal	0,800	35,000	28,00
				<u>200,00</u>
	Totale oeskoste per ha:			<u>400,38</u>
	Oeskoste per ton:			<u>200,19</u>
	Totale ge-allokeerde koste per ha:			1 881,29
	Ge-allokeerde koste per ton:			940,65
3	BRUTO MARGE PER HEKTAAR:			745,81
	BRUTO MARGE PER TON			<u>372,90</u>

KATOEN

	Eenh	Prys of koste/eenh	Hoef	Waarde per ha	
<hr/>					
1	Bruto inkomste uit produksie:				
	Katoen	Ton	1 372,000	3,000	4 116,00
	Minus hef.kat raad	kg	0,045	500,000	<u>157,50</u>
	Inkomste - Heffings (per ha):				<u>3 958,50</u>
<hr/>					
2	Ge-allokeerde koste:				
	Voor-oes				
	Katoensaad	kg	2,040	25,000	51,00
	2.3.4 (30).75%Zn	kg	0,768	400,000	307,20
	Amm sulfaat (21)	kg	0,367	400,000	146,80
	Temik	kg	20,120	10,000	201,20
	Deces	l	60,000	1,500	90,00
	Thioflo	l	23,780	2,000	47,56
	Arb. uitdun	dae	5,000	2,500	12,50
	Vers. hael				720,30
	Arb. skoffel	dae	5,000	10,000	50,00
	Treflan	l	18,400	1,000	18,40
	Masjinerie				400,00
	Waterkoste				388,00
	Rente op bedryfsuitgawe				<u>94,23</u>
	Totale voor-oeskoste per ha:				<u>2 527,19</u>
	Voor-oeskoste per ton:				<u>842,40</u>
	Oes:				
	Arbeid				660,00
	Vervoer				<u>93,40</u>
	Totale oeskoste per ha:				<u>753,40</u>
	Oeskoste per ton				<u>251,13</u>
	Totale ge-allokeerde koste per ha:				3 280,59
	Geallokeerde koste per ton:				1 093,53
<hr/>					
3	BRUTO MARGE PER HEKTAAR				677,91
	BRUTO MARGE PER TON				225,97

KORING

	Eenh	Prys of koste/eenh	Hoev	Waarde per ha
<hr/>				
1	Bruto inkomste uit produksie:			
	Koring	Ton 500,00	5,000	2 500,00
	Koringstrooi	Ton 80,00	2,250	<u>180,00</u>
	Inkomste - Heffings (per ha):			<u>2 680,00</u>
<hr/>				
2	Ge-allokeerde koste:			
	Voor-oes:			
	Koringsaad	kg 1,000	130,000	130,00
	2.3.1 (25).5%Zn	kg 0,676	350,000	236,60
	Amm sulfaat (21)	kg 0,367	600,000	220,20
	Buctril	l 44,960	1,000	44,96
	Vers. hael			107,80
	Metasystox	l 25,300	0,300	7,59
	Folidol	l 18,990	0,300	5,70
	Masjinerie			400,00
	Waterkoste			388,00
	Rente op bedryfsuitgawe			<u>94,36</u>
	Totale voor-oeskoste per ha:			<u>1 635,21</u>
	Voor-oeskoste per ton:			<u>327,04</u>
	Oes:			
	Kontr.-str	Ton 60,000	5,500	330,00
	Kontr.-vervoer	km/T 0,600	66,000	39,60
	Kontr.-baal	baal 0,800	150,000	<u>120,00</u>
	Totale oeskoste per ha:			<u>489,60</u>
	Oeskoste per ton			<u>97,92</u>
	Totale ge-allokeerde koste per ha:			2 124,81
	Geallokeerde koste per ton:			424,96
<hr/>				
3	BRUTO MARGE PER HEKTAAR:			555,19
	BRUTO MARGE PER TON			<u>111,04</u>
<hr/>				

LAAT MIELIES

	Eenh	Prys of koste/eenh	Hoef	Waarde per ha
1 Bruto inkomste uit produksie:				
Mielies	Ton	322,00	7,000	2 254,00
2 Ge-allokeerde koste:				
Mieliesaad PNR394	kg	2,900	20,000	58,00
MAP(33).75%Zn	kg	1,086	100,000	108,60
UAN	kg	0,604	620,000	374,48
Bladex Plus	l	19,182	1,500	28,77
Guardian	l	50,530	1,000	50,53
Agrisulfan	l	18,586	1,500	27,88
Sumithidin	l	105,600	0,200	21,12
Versekering hael				90,16
Masjinerie (huur)				400,00
Waterkoste				388,00
Arbeid				120,00
Kontrakstroop en vervoer				290,00
Rente op bedryfsuitgawe				71,45
Totale ge-allokeerde koste per ha:				2 028,99
Geallokeerde koste per ton:				289,86
3 BRUTO MARGE PER HEKTAAR:				
BRUTO MARGE PER TON				255,01
				32,14

3.3. Cost of land

The suggestion that found most favour during the workshops was that farmers be held accountable for 20% of their debt with Lesedi and that this should be the price that they pay for the land. The reasoning behind this is that although many causes of the debt were outside the farmers' control (flood, drought, pivot breakdown, choice of production system) farmers must take some of the blame for the poor financial performance of the scheme. It is also a fact that land is really the only asset on the scheme that could be used to recover a portion of the debt.

We believe that the price of land should be separated from the debt issue. At most it could be used as a screening mechanism by making it a condition that an agreed portion of the debt be repaid before any option can be implemented that would enable continued access to the land. Those farmers (or their nominees) that do not exercise their option to acquire their land will then have to withdraw from the scheme in exchange for a write-off of their debts. The farmers remaining on the scheme or any other suitable candidates could then tender for these lands.

An issue that was raised at the report back to the farmers was the matter of to whom this money should be paid. We have not endeavoured to answer this question, but it should certainly be resolved before any selling of land can take place. On the one hand land is the only worthwhile asset that could be used to offset debt, but on the other hand there seems to be controversy as to who actually owns the land.

For the analysis which follows two hypothetical land prices were used. One is based on the reasoning in paragraph 5.5 of the third report in this series and the second is considerably lower.

3.4 Sensitivity analysis

3.4.1 Specification of basic model



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Farm size:

10 ha for pivot farmer and 7,5 ha for sprinkler farmer.

Crop rotation:

The prescribed cropping rotation allows the 10 ha pivot farmer to grow 3,3 ha cotton, 3,3 ha maize 3,3 ha groundnuts and 6,6 ha wheat each year (model P1) or 10 ha groundnuts and 10 ha wheat in year one, 10 ha maize in year two and 10 ha cotton and 10 ha wheat in year three (model P2). It allows the 7,5 ha sprinkler farmer to grow 2,5 ha cotton, 2,5 ha maize, 2,5 ha groundnuts and 5 ha wheat each year (model S1) or 7,5 ha groundnuts and 7,5 ha wheat in year one, 7,5 ha maize in year two and 7,5 ha cotton and 7,5 ha wheat in year three (model S2).

Period of analysis:

Twenty years. This seems to be a realistic time period over which to evaluate restructuring implications.

Income and production cost:

As specified in the crop budgets

Price levels:

Constant at 1991 prices.

Production efficiency:

As specified in the crop budgets (which are based on 100 per cent efficiency, i.e. what can reasonably be expected with good management in this area).

Water cost:

The pivot farmer is renting a pivot from Agricor. The water cost is R388/ha/crop/annum. The sprinkler farmer is at Mokassa. The water cost is R465/ha/crop/annum. No subsidization is taken into account.

Land and infrastructure cost:

Nothing is paid for the use of land in the basic models. The beginning and end values of infrastructure is not taken into account as they are deemed to be sunk costs.

3.4.2 Impacts investigated



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- Changes in crop rotation

As specified in the basic model two variants of the prescribed crop rotation exists. The first is where the areas planted with the different crops remained the same each year (models P1 and S1) and the second is where the areas planted differ between years within a three year cycle (models P2 and S2).

- Changes in efficiency

Besides the constant 100 per cent efficiency assumed in the basic models, three levels of efficiency were researched. In each of these cases a drop in efficiency was assumed during the first year of implementation. This inefficiency is then phased out over three, five or nine years. The efficiency levels assumed are as follows:

Year	Phasing out period		
	3 year	5 year	9 year
1	60	60	60
2	75	70	65
3	100	80	70
4	100	90	75
5	100	100	80
6	100	100	85
7	100	100	90
8	100	100	95
9	100	100	100

- Water cost variation

- (a) Renting a pivot from Agricor R388/crop/ha/annum.
- (b) Farmer owning a pivot R605/crop/ha/annum for 7 years and R272/crop/ha/annum after 7 years.
- (c) Farmer renting pump and pipe on a rotation basis R532/crop/ha/annum.
- (d) Farmer buying his own pipeline, pump and sprinkler equipment R600/crop/ha/annum for 7 years and R279/crop/ha/annum after 7 years.
- (e) Farmer buying his own pump and pipeline and converts to flood irrigation R549/crop/ha/annum.
- (f) Sprinkler system at Mokassa R465/crop/ha/annum.
- (g) Flood option at Mokassa R506/crop/ha/annum.

- Changes in land tenure

Two possibilities were evaluated namely renting the land at rates of R125 and R150/ha/annum or buying the land at prices of R735 and R1 200/ha. (The motivation for the higher value is discussed in paragraph 5.5 of volume III).

- Changes in price ratios

The impact of the continuation of the price/cost squeeze that prevailed during the past 10 years were also considered. With this analysis the prices of crops were kept constant at 1991 levels while the prices of all farming inputs were increased at a rate of 2,4 per cent per annum.

3.4.3 Evaluating criteria

The following criteria were used to compare the outcome of the different analysis.

- Net Present Value (NPV): The net present value of the yearly gross margins of the typical farms were calculated using three discount rates,

namely 0, 3 and 8 per cent. These rates cover a wide enough range to compare alternative options.

- **Benefit/Cost (B/C):** The B/C ratios were calculated by dividing the total discounted farming income by the total discounted farming cost. This was also done for three discount rates, namely 0, 3 and 8 per cent.
- **Average Gross Margin (AVG GR MARGI)** This value was calculated as the average annual gross margin for 20 years.
- **Average Retainable Income (AVG RE MARGI):** This value was calculated by deducting the cost of land from the annual gross margins and averaging over 20 years.
- **Internal Rate of Return (IRR):** This rate was calculated by dividing the total retainable income by the total cost and expressing it as a percentage.
- **Years with Negative Gross Margins (YEARS NEG GR):** This is the number of years (out of 20) that a negative gross margin occurred.

3.4.4 Results



(a) Changes in cropping rotation

Table 1 gives the outcome of the analysis of the basic model for a typical 10 ha pivot and a typical 7,5 ha sprinkler farmer. As mentioned P1 and S1 represent the situation where the crop mix remained the same each year while in P2 and S2 a three year cycle was built in. The following can be noticed from Table 1

- Regarding all the criteria except years with a negative gross margin the 10 ha pivot farmer is better off than the 7,5 ha sprinkler farmer.
- Looking at the average yearly gross margins and comparing them to the norm of R6 000/year it can be seen that the pivot farmer is exceeding it by more than R3 000/year while the sprinkler farmer's income falls somewhat short.
- Although the average gross margins in models P1 and S1 (constant crop mix over years) are somewhat higher than that of P2 and S2 respectively the difference are marginal. P2 and S2 are easier to implement than P1 and S1 (especially under sprinkler irrigation) and should be recommended. The main problem with these systems are that the gross margins are relatively low every second year of a three year cycle as only one summer crop (maize) is planted so that special provision must be made to bridge the low income years.

(b) Changes in efficiency

With the 100 per cent production efficiency assumed in the basic models relaxed, Table 2 shows the impact for three possibilities of inefficiency. It is obvious that the longer the period of inefficiency prevails the lower the levels of the different financial criteria become. In the case where it takes 5 years to return to 100 per cent efficiency the average yearly gross income of P2 drops from R9 040 (under 100 per cent efficiency) to R7 102 and that of S2 from R5 827 to R4 374. For 3 and 5 years to reach 100 per cent efficiency 2 years of negative gross income occur while for 8 years of inefficiency (9 years to reach 100 per cent efficiency) 4 years of negative gross income will be experienced.

(c) Changes in water cost

Table 3 shows the effect of changes in water cost on the different evaluating criteria. It is clear from the figures that the systems where a pivot farmer rents a pivot from Agricor and a farmer at Mokassa uses a sprinkler system are financially the more efficient systems.

(d) Changes in land tenure



The impact of renting land and buying land are showed in Table 4. Looking at the average yearly retainable income it can be seen that renting is more profitable but that the effect between renting at R150 per year and paying R735 per ha for land (payback period of loan 20 years at an interest of 17 per cent per annum) is only marginal. Given the special benefits that owning land has to the farmer, it is recommended that the farmer should be motivated to buy rather than rent the land.

(e) Changes in relative prices

When the average tendencies of price movements that had occurred the past 10 years are built into the models (where the prices of farming inputs rises in general 2,4 per cent per year more than that of crops) a very negative picture emerges as is shown in Table 5. With all models, negative average yearly retainable income will be experienced with 10 and more years of negative gross income. Under this scenario the best would be to terminate irrigation.

3.5 Model used for all further calculations

A parameter combination have to be selected arbitrarily for the financial, cost-benefit and macro-economic analyses. The following were selected:

- A pivot farmer rents a pivot from Agricor at R388/crop/ha/annum and the sprinkler farmer uses a sprinkler system at a cost of

R465/crop/ha/annum.

- The period of inefficiency is four years.
- The three year crop rotation cycle applies.
- Land is rented at R125/ha/annum or bought at R735/ha.
- Prices between crops and inputs stay constant over the 20 year period.

Under these assumptions the average yearly retainable income respectively for renting and buying land are R6 977 and R6 683 for the pivot farmer and R4 249 and R4 060 for the sprinkler farmer (Table 6). The yearly retainable income are shown in Figures 1 and 2. (Figures 1a and 2a are include for comparison and illustrates the levelling influence of multi-crops on retainable income. Because of the practical difficulties inherent in such a system it will not be considered in the further analyses). It can be seen from these figures that negative retainable income occurs during the first 2 years for the pivot farmer and first 3 years for the sprinkler farmer. After the period of inefficiency has been phased out the retainable income will be relatively high for a two year period to drop to very low in each third year. For the pivot farmer the high retainable income will be around R12 000 per year with the low retainable income around R2 000 per year. In the case of the sprinkler farmer the high retainable income will be around R8 000 per year with the low around R800 per year.

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3.6 The impact of "free" land

Table 6a illustrates the effect of gratis land on the results reflected in table 6. Non-payment for land puts an extra R683 (if price of land = R1200/ha) or R419 (if price = R735/ha) in the pocket of the pivot farmer. The corresponding figures for sprinkler farmers are R314 and R512. These savings to the farmer must be weighed against the psyhological and political benefits derived from paying for the land.

3.7 The impact of water restrictions

To investigate the impact of water restrictions on income, a fifty percent reduction in available water was assumed for years 10, 11 and 12. During these years crop production is restricted to wheat only. The results are summarised in table 6b and illustrated in figure 5. The serious loss of income is clearly shown by the graph.

4. INSTITUTIONAL MODULE

4.1 Tenure system

The workshop was overwhelmingly in favour of freehold title. Leasing from the state was not even considered worth discussion. This may well be an over-reaction to past prescriptive policies and the resultant wish not to be exposed to possible State interference. We believe that provision should be made for various tenure options, namely

- leasehold
- certificate to occupy, ore
- freehold title

The key factor is that land tenure should be tradeable. An interesting observation is that every time that possible alienation of land (once they owned it) was discussed by farmers, this was associated with leasing rather than selling. To what extent this perception will change once the opportunity for capital gains arises is unpredictable and essentially irrelevant for the purpose of replanning. One can but speculate that the preference for leasing might initially expedite some degree of rapid consolidation of land in the hands of efficient farmers, and that this process will occur with maximum benefit to both parties. It is conceivable that quite a number of the current tenants will for some reason or other (e.g. age or outside interests) prefer to benefit indirectly without relinquishing ownership to the land.



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4.2 Surveying and title deeds

At a recent workshop on land reform organised by SECOSAF and attended by representatives from Bophuthatswana, the following observations were made which are extremely relevant to the Taung situation.

- On existing land you do not need to wait for a survey before giving title. What you need is either a description of the property or a map with "general" boundaries (as opposed to the "fixed boundaries" associated with surveying).
- A diagram based upon and superimposed on orthophoto maps has proved to be extremely useful for planning and entitlement purposes in squatter settlements near Durban.

An orthophoto map of the Taung irrigation scheme should be compiled as a matter of urgency and freehold title issued to those farmers who so wish. Leaseholds and Certificates to Occupy could also be based on these maps. This could be done within months rather than years and addresses the very core of restructuring. Orthophoto maps would also expedite road planning and servitudes.

It may be wise to defer formal surveying to establish numerical co-ordinates for a few years, thus allowing for a certain degree of spontaneous consolidation to take place. The example of Vaalharts is a case in point. Originally each farmer was allocated one 21,4 hectare unit. Over time, through a process of natural selection for aptitude and competence, about three-quarters of the owners left the scheme with the result that at present the average holding varies between two and three units, tending towards three units. The same process at Taung need not necessarily lead to the same plot size, but it will certainly reach a short-term equilibrium according to the means and needs of Bophuthatswana citizens. This equilibrium value is unpredictable. What can be predicted is that it will change over time.

Subdividing the present scheme into individual lots will automatically increase the size of the holdings. (You cannot logically subdivide into circles). Adding on to the circles will benefit the farmer in two ways: Firstly, it would allow those living at a distance to live on their land which would promote better management and provide greater security for both crops and equipment. Secondly, it would promote the integration of some livestock activities with the irrigation.

Access to individual lots could be provided for by a combination of planned roads and servitudes. For example, the underlying principle could be to ensure road access to each pivot and servitudes to reach the road from each sector.

4.3 Farm size and farmer selection

Some form of prior selection of prospective farmers by a state appointed committee was totally unacceptable to the farmers. The consensus opinion was that present owners should get first option to acquire the piece of land which they presently occupy, and thereafter natural market forces would determine who will eventually remain on the land.

An extremely important principle that came out of the report back to the farmers was that a farmer must have the right to nominate a family member to take over his option to acquire his piece of land. Naturally this right applies only to the first round of ownership.

4.4 Agribank and the farmer

There was a strong current of opinion that the farmer should negotiate directly with Agribank. A minority opinion was that Agribank should finance production through the Co-operatives. Officials from the bank pointed out that dealing directly with the bank would imply that the bank would have to open a branch in Taung. Some of the key issues with regard to production loans are

- Once the farmer and the bank had agreed upon the amounts and purposes of the loan, the farmer would get a voucher to buy his inputs. This voucher would be valid for use with any input supplier or contractor with

which the farmer may choose to do business. In the case of money for paying labour the farmer will draw cash amounts from the bank. (It was quite striking that many farmers did not even want to have an account with the Co-operative).

- Similarly, when the Co-operative pays the farmer for produce received the money is paid directly to the farmer and he will be responsible for settling his debt with the bank. This issue is deemed so important that it was raised in both the workshop on finance and the one on the production.
- The bank will be solely responsible for credit control.
- Agribank would have to devise lending criteria to suit the Taung situation. The farmer's ability to service the loan must be a decisive factor. Interest rates should be market related. Again the point must be made that the option should be available to those farmers who prefer to obtain their production finance from the Co-operative.
- Right of pledge (pandreg) on crops as a security for crop production loans is a practice that will necessarily apply.

4.5 The need for a co-operative



The co-operative function of providing inputs and marketing controlled produce must be performed by someone. Due to the negative attitude of farmers towards Lesedi, and the fact that Vaalharts Co-operative serve 40 000 hectares compared to the 3500 ha at Taung, the opinion was expressed that the Taung farmers simply join Vaalharts and dispense with an own co-operative. This however is a political decision which have to be taken against the background of (i) bi-lateral agreements between Bophuthatswana as an independent country and the RSA, and (ii) the best interests of the farmers at Taung. An indication of the latter is provided by the fact that farmers were clearly more "comfortable" with their primary co-operative than with even Lesedi, primarily because of a shorter chain of communication. The establishment of a new co-operative can only be on demand from the farming community. If they prefer not to have a co-operative a "shop" should suffice, in which case it should be the responsibility of private enterprise.

A primary co-operative is normally founded by a group of farmers for their own benefit and therefore funded and managed by its members. The two basic functions of such a co-operative is to supply inputs at competitive prices to members and to market their produce, especially if these are controlled.

The present primary co-operatives does not function in this manner at all. Lesedi is currently operating as if it was the primary co-op, but without having its clients as members.

A substantial number of farmers at the feedback meetings expressed a preference for their local primary co-operative as opposed to a single large co-operative. These meetings were conducted by the Primary Co-operative managers, who had to present the results from six workshops in one session. Time may be did not allow for all the arguments to be fully grasped. It seemed however that the consultants' explanation that the high overhead costs induced by the relatively small scale of operations was prohibitive, was eventually accepted by the majority of those present. These reservations do however show the importance of getting farmer support for any new co-operative structure.

Any co-operative should have a Board of Directors elected by the farmer members and should generate income through the following sources:

- membership fees
- annual subscriptions
- profit on trading activities
- agency fees from the Marketing Board
- a temporary annual grant from the Government

Should a single co-operative be formed, it is recommended that two representatives from each of the former primary co-op areas should serve on the Board. Experience has shown that a large board leads to extremely cumbersome decision-making with the result that board members loose interest. It also tends to promote group forming and polarisation within the board. The concept of area representation is generally accepted in agricultural co-operatives. In the Taung case it will furthermore promote efficient feedback to the farmers. This should preferably take the form of regular report back sessions after each board meeting, especially during the first few years.

4.6 Communicating the new co-operative structure to farmers

The Interim Management Board is currently investigating the best possible way to achieve a true primary co-operative. The current level of mistrust in Lesedi will necessitate a great effort in future to ensure member loyalty to a co-operative. Regardless of whether this attitude is justified or not (we believe it is mostly undeserved) it is a fact that will have to be dealt with in the process of creating a single co-operative. Farmers have not really been exposed to the true nature of an agricultural co-operative, and a lot of groundwork will be required to ensure farmer support. Special meetings will have to be held and the concept must be patiently explained to all future members. Farmers must not be expected to join en masse.

4.7 Extension

Function

Farmers were unanimous about the need for extension services. They were also unanimous that extension staff should be true professionals in the sense that they should not be involved in any other activities than extension work. Extension staff should not do for the farmer what he can and should do for himself. Furthermore, they should not be involved in regulatory functions such as credit control. All non-extension activities should be done by the production officers proposed in paragraph 2.1.

Organisation

It was further agreed that there should only be one extension service and the opinion was expressed that if extension is to be purely involved in extension activities there should be a pure extension branch within the Agricor district office structure, headed by an extension specialist. No additional staff were required for extension. What was needed was re-organisation of the present staff. Although every participant in the workshop agreed with the concept of extension staff being only involved with extension, through force of habit the first reaction was to retain this serve within the present management support services. We would strongly recommend that a separate extension division be created within the district office.

Farmer participation

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The other main point which came out of the extension workshop was the importance of involving farmers in both the planning and the implementation of extension. (Many suggestions were made upon how this should be done and about strategy in general. These will be dealt with in the report to the Steering Committee).

5. FINANCIAL MODULE

5.1 Debt payment

To make a transition from the present situation (where production decisions were mainly made for them) to a system of own decision making, is going to be a learning process. It is reasonable to expect that production efficiency will initially decrease substantially, say to a level of 60 per cent of the required efficiency to farm profitable. It is further expected that the efficiency will then gradually increase (with an effective education/extension programme) to reach the level suggested in the budgets after a period of time.

Under this expectation (and given that farmers must also make a profit to pay for household expenses and to pay for land) it is doubtful whether it will be possible

to repay the current debt.

As far as co-operative debt is concerned, it may be necessary in order to make an effective transition to a new viable co-operative, that all outstanding debt should be written off.

5.2 Farmer assistance

Based on the information of Table 6, Table 7 provides information about the financial criteria for the total irrigation area (3 589 ha). From the table it can inter alia be seen that the total average yearly retainable income of farmers at 1991 prices are R2,36 million when the land is rented at a price of R125/ha and R2,26 million when land is bought at R735/ha. The benefit/cost ratios at 0% discounting are plus minus 1,17.

Table 8 gives an overview of the yearly income, cost and retainable income. From the table the negative retainable income during the transitional phase is clear and confirms the need for financial assistance during this phase. Figure 3 and 4 (based on Table 8) presents an overview of the flow of income, cost and retainable income.



Given that the relative prices between crops and inputs are kept constant over the 20 year period, the projected retainable income figures can be regarded as optimistic. With this in mind and also the fact that overhead farming cost such as transport still has to be paid out of the calculated retainable income it should be obvious that the farms are not large enough to supply adequate income for full time farmers over the long run. It is however expected that successful farmers will increase the size of their farms over time in a process of natural selection in a free market environment. Taking the present farm sizes as a starting point and the figures in table 6 as a basis for calculating the financial assistance needed to assist farmers in making the transition to the new dispensation the following amounts (at 1991 prices) are needed per year per farmer to provide for a R6 000 retainable income. It is suggested that the farmers must only be helped for a five year period.

Year	Pivot farmer		Sprinkler farmer	
	Rent	Buy	Rent	Buy
1	R10 748	R11 965	R10 774	R11 628
2	R 9 767	R10 752	R 9 434	R10 142
3	R 4 585	R 5 404	R 6 125	R 6 708
4	R 0	R 0	R 835	R 1 312
5	R 3 875	R 4 432	R 5 015	R 5 401

To round off the assistance figures the following amounts (at 1991 prices) are suggested.

Year	Pivot farmer	Sprinkler farmer
1	R11 000	R11 000
2	R10 000	R10 000
3	R 5 000	R 6 000
4	R 0	R 1 000
5	R 4 000	R 5 000

Extrapolating these figures to cover the total scheme (2 514 ha pivots and 1 075 ha sprinklers) the amounts (R) needed at 1991 prices are as follows

Year	Pivot farmers	Sprinkler farmers	Total
1	2 756 400	1 576 630	4 342 030
2	2 514 000	1 433 300	3 947 300
3	1 257 000	859 980	2 116 980
4	0	143 330	143 330
5	1 005 600	716 650	<u>1 722 250</u>
			<u>12 271 890</u>

Farmers must be fully responsible for all expenses they exercise control over. Subsidization should be limited to the expenses which are fixed, i.e. the cost of land, pivot rent and water tax.



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5.3 Institutional cost to support the models

5.3.1 Agribank

For Agribank to deal directly with farmers in the Taung area according to the proposed model an office must be established with the necessary infrastructure and personnel. An amount of R750 000 is needed for establishment and the yearly running expenses are projected at R425 000. These amounts will be grants from the Bophuthatswana Government. Ninety per cent of these amounts can be booked against the irrigation project; ten per cent of the use of the Taung office will be for other purposes in the region.

5.3.2 A Co-operative

For a new co-operative to become viable in a dispensation where farmers will have freedom of choice and where the farmers must go through a learning phase, financial assistance in the form of grants will be needed for a number of years. Utilizing the income accounts of Lesedi for the past couple of years and taken into account the structural changes needed to move from the existing to a new co-operative, as well as the projected production efficiency ratios of farmers in the transitional phase, it is expected that the following grants at 1991 price levels may be needed for the new co-operative to become viable and break even.

Year	Grant (R)
1	1 500 000
2	1 125 000
3	750 000
4	375 000
5 and onwards	0

5.3.3 Agricor

The role of Agricor will be focused on the rendering of support services. Specific tasks include

- To act on behalf of the Department of Agriculture in supplying extension services.
- To work in close co-operation with the Department of Water Affairs in Bophuthatswana to purchase water wholesale from the RSA and to distribute the water over the irrigation region. Maintenance of the infra-structure is an important task.
- To render typical irrigation functions such as to distribute the purchased water to the land's edge and to maintain the required infrastructure.



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With the 1991/93 budget (based on the new role of Agricor) as a basis, the operational and expenditure budget at 1991 price levels are projected to be as follows

Year	Operations (R)	Development (R)	Total (R)
1	2 700 000	5 300 000	8 000 000
2	2 700 000	5 300 000	8 000 000
3	2 700 000	5 300 000	8 000 000
4	2 700 000	5 300 000	8 000 000
5	2 700 000	5 300 000	8 000 000
6 and onwards	2 700 000	2 700 000	5 400 000

The development budget will be relatively high for the first five years in order to do a lot of necessary development and maintenance work after which it will be much lower. It is important to note that expenses to develop and service the undeveloped 1 500 ha irrigable area are not included in the projected amounts.

6. MACRO-ECONOMICS

6.1 Turnover

It is argued above that total turnover from farming (at constant prices) will initially decline sharply say to 60 per cent of the projected turnover. After that a gradual increase can be expected. At 1990 prices it may decrease initially to R5 or R6 million and then increase to R10 million per year after a number of years.

As a result of this and also the fact that farmers will have freedom to buy inputs from any provider it is expected that the R20 million annual turnover of the co-operative will decline initially to say R10 million and then increase to R25 million after 10 years (as business with non members is expanded).

6.2 Government Grants

In order to make the proposed changes possible, government may have to supply the following financial support

- Interest subsidies on production loans
- Subsidies on the fixed cost of irrigation systems
- That amount of farmer and co-operative debt that have to be written off
- Grants over a period of say four years , in order to make the co-operative viable
- Maintenance of infrastructure on the irrigation scheme
- Agricor expenses

6.3 Benefit/cost analysis

This preliminary benefit/cost analysis is based upon the parameter combination specified in paragraph 3.5. Constant 1991 prices are used. The value of the infrastructure at the beginning and at the end of the 20 year period is excluded from the analysis, based upon the sunked cost argument. The results are presented in table 9. The following is of note:

- Counting only the income to farmers from the sale of agricultural produce as the benefits of the scheme, a negative net present value is obtained. The amount by which the total costs exceed the total benefits at a zero discount rate is for instance R84,8 million, or R4,24 million per annum.

- The cost/benefit ratio differs between 0,79 for a zero discount rate and 0,74 for an eight per cent discount rate.
- The internal rate of return (excluding the starting and end values of existing infrastructure) is -21,2 per cent.

It is clear from these preliminary figures that if the Taung irrigation project is considered as a purely commercial venture, the restructuring of the scheme does not pass the criteria for executability.

A preliminary exercise with shadow pricing shows that both benefits and cost will decrease. The decrease in benefits will however be larger, so that the economic outcome will be even more unfavourable compared to the use of current prices.

6.4 Fiscal impact

The fiscal impact on Government at 1991 prices is shown in table 10. The total negative impact is R145,3 million over the 20 year period, with the greatest effect occurring over the first five years. Excluded from the analysis is the present circa R 30 million owed by farmers and Lesedi. The positive impact of direct and indirect taxes as a result of economic activity in the area was not assessed.



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FIG 18: RETAINABLE INCOME FOR 10 HA PVDOT FARMER
CONCURRENT PLANTING OF DIFFERENT CROPS

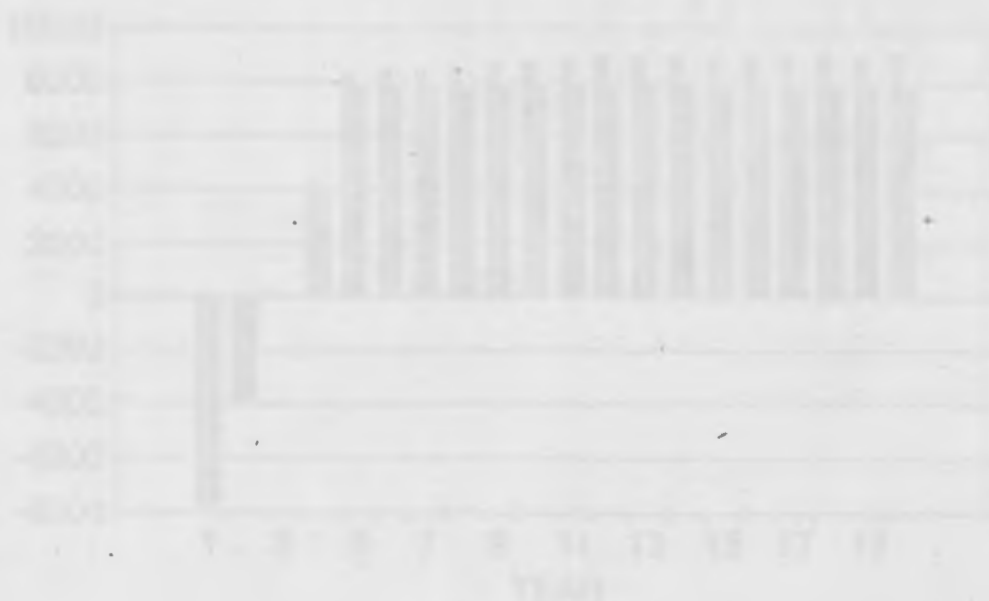
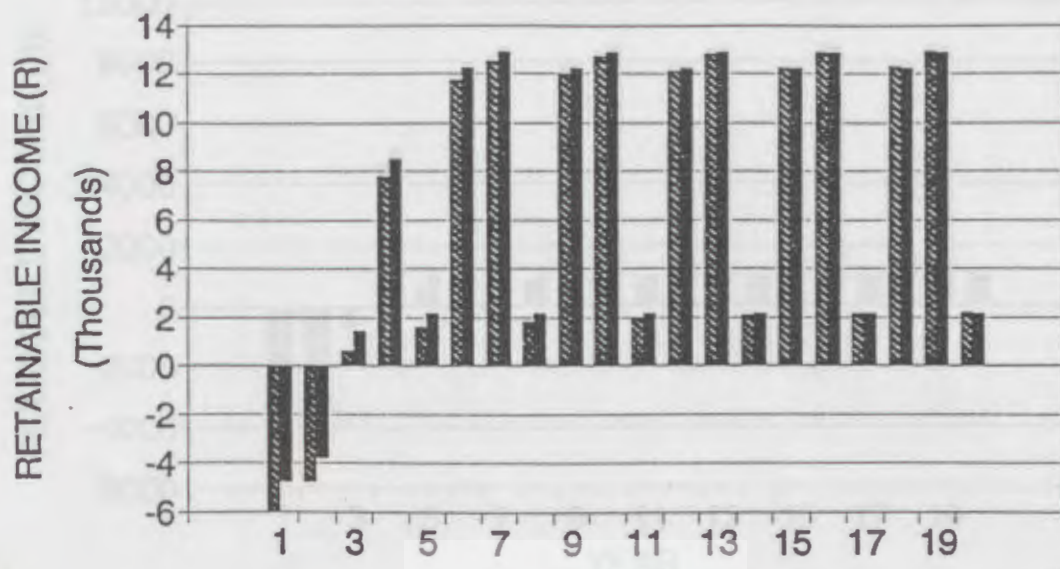


FIGURE 1: RETAINABLE INCOME FOR 10 HA PIVOT FARMER

(SEQUENTIAL PLANTING OF DIFFERENT CROPS)

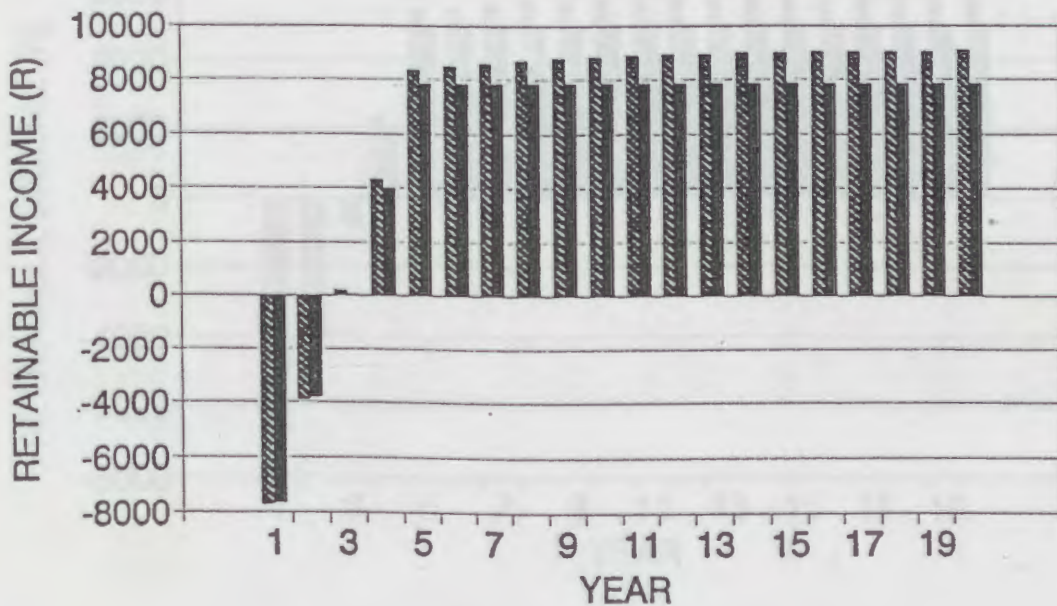


BUY RENT

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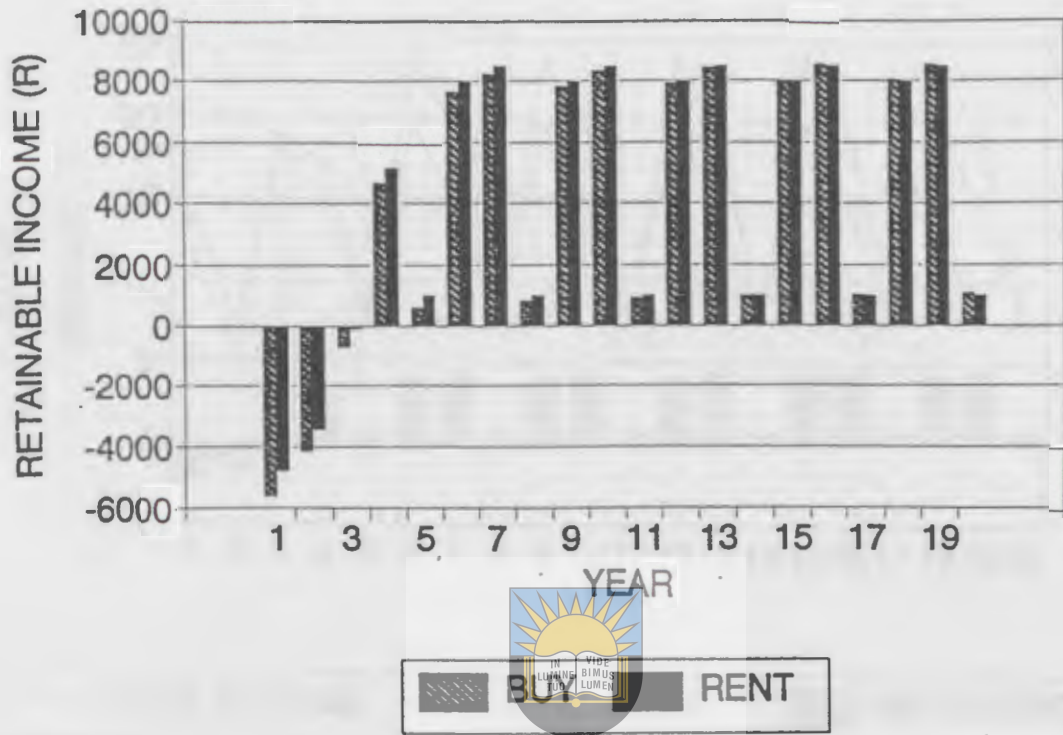
FIG 1a: RETAINABLE INCOME FOR 10 HA PIVOT FARMER

(CONCURRENT PLANTING OF DIFFERENT CROPS)



BUY RENT

FIGURE 2: RETAINABLE INCOME FOR 7.5 HA SPRINKLER FARMER (SEQUENTIAL PLANTING)



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FIG 2a: RETAINABLE INCOME FOR 7.5 HA SPRINKLER FARMER (CONCURRENT PLANTING)

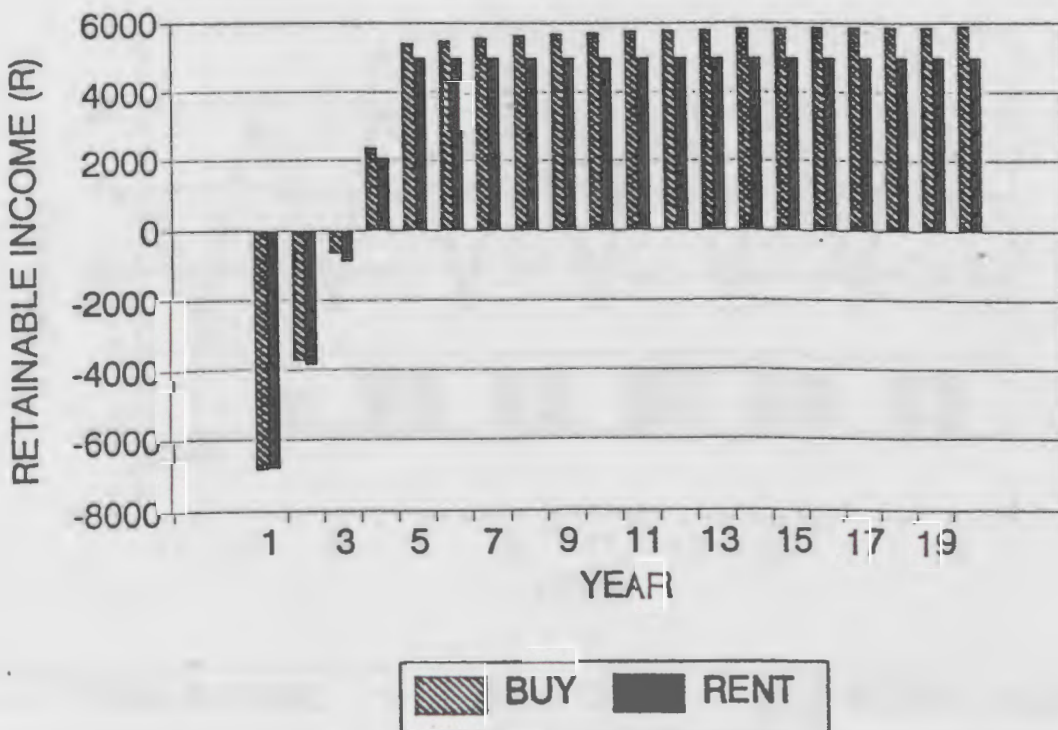


FIGURE 3: RETAINABLE INCOME FOR FARMER BUYING LAND

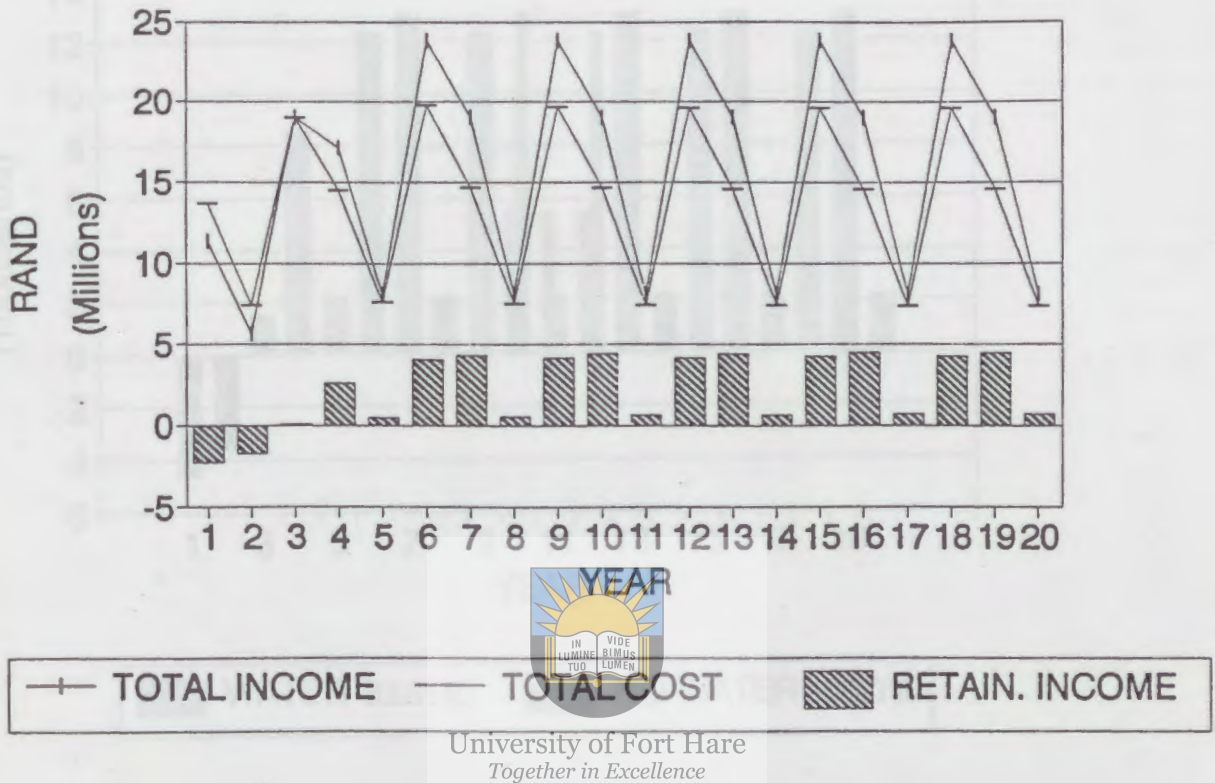


FIGURE 4: RETAINABLE INCOME FOR FARMER RENTING LAND

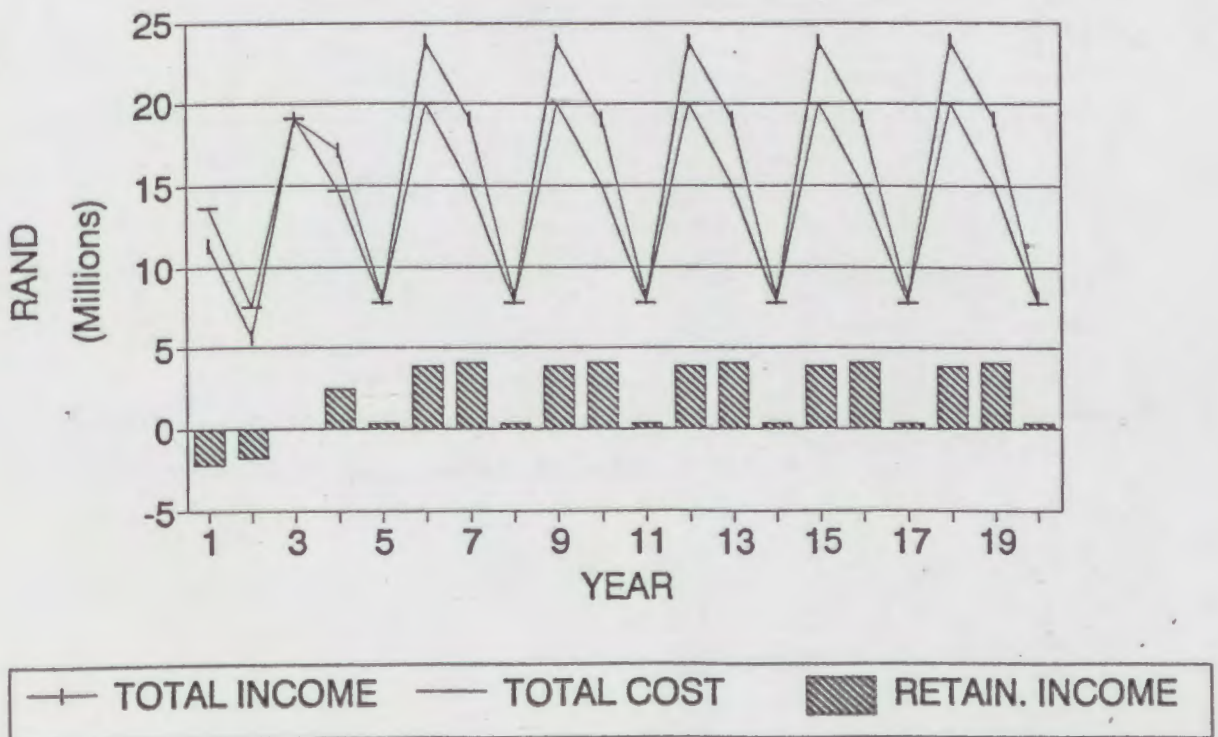


FIGURE 5: RETAINABLE INCOME FOR 10 HA PIVOT FARMER WITH WATER RESTRICTIONS

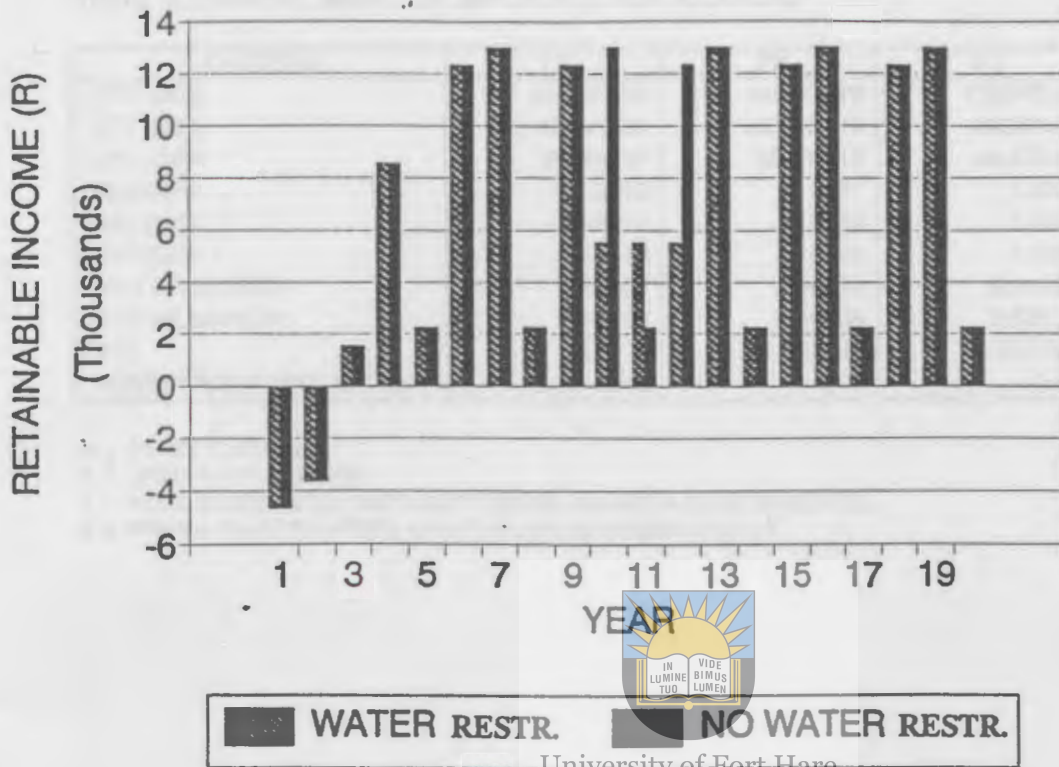


TABLE 1: FINANCIAL IMPACT OF DIFFERENT CROP ROTATIONS

CRETERIA	P1	P2	S1	S2
NPV @0%	182,101.30	180,806.70	118,705.50	116,547.50
NPV @3%	135,460.30	135,262.70	88,301.90	87,230.05
NPV @8%	89,394.85	89,918.15	58,273.40	58,023.08
B/C @0%	1.2412	1.2421	1.2008	1.2012
B/C @3%	1.2412	1.2430	1.2008	1.2020
B/C @8%	1.2412	1.2445	1.2008	1.2034
AVG GR MARGIN	9,105.06	9,040.34	5,935.28	5,827.38
AVG RE MARGIN	9,105.06	9,040.34	5,935.28	5,827.38
IRR	24.1171	24.2115	20.0762	20.1242
YEARS NEG GROSS MARGIN	0.00	0.00	0.00	0.00

P = PIVOT FARMER

S = SPRINKLER FARMER

1 = PLOT SUBDIVIDED, DIFFERENT CROPS PLANTED CONCURRENTLY

2 = WHOLE PLOT PLANTED, CROPS PLANTED SEQUENTIALLY



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TABLE 2: FINANCIAL IMPACT OF CHANGES IN PRODUCTION EFFICIENCY

CRETERIA	P1 *			P2		
	3 **	5	9	3	5	9
NPV @0%	156,840.40	143,236.40	112,148.10	156,228.20	142,038.10	111,614.60
NPV @3%	111,210.00	98,612.48	71,994.43	113,480.70	98,755.19	72,472.08
NPV @8%	66,671.55	55,978.98	34,662.34	66,348.91	56,694.05	35,817.80
B/C @0%	1.2092	1.1917	1.1514	1.2131	1.1922	1.1523
B/C @3%	1.1998	1.1783	1.1312	1.2054	1.1798	1.1322
B/C @8%	1.1822	1.1539	1.0964	1.1906	1.1570	1.1004
AVG GR MARGIN	7,842.02	7,161.92	5,607.41	7,911.41	7,101.91	5,560.73
AVG RE MARGIN	7,842.02	7,161.92	5,607.41	7,911.41	7,101.91	5,560.73
IRR	20.9155	19.1732	15.1412	21.3103	19.2210	15.2318
YEARS NEG GROSS MARGIN	2	2	4	2	2	4

CRETERIA	S1			S2		
	3	5	9	3	5	9
NPV @0%	99,568.49	89,263.95	64,238.63	99,613.67	87,471.08	64,653.41
NPV @3%	69,930.42	60,538.37	38,811.36	70,893.54	59,849.44	40,137.09
NPV @8%	41,058.78	32,958.34	15,547.31	42,596.16	33,105.01	17,447.68
B/C @0%	1.1695	1.1525	1.1107	1.1730	1.1526	1.1137
B/C @3%	1.1604	1.1395	1.0903	1.1654	1.1404	1.0951
B/C @8%	1.1432	1.1156	1.0552	1.1509	1.1181	1.0630
AVG GR MARGIN	4,978.43	4,463.20	3,211.93	4,960.66	4,373.55	3,232.67
AVG RE MARGIN	4,978.43	4,463.20	3,211.93	4,960.66	4,373.55	3,232.67
IRR	18.9525	15.2531	11.0743	17.2982	15.2578	11.3699
YEARS NEG GROSS MARGIN	2	2	4	2	2	4

* P1, P2, S1 AND S2 AS IN TABLE 1

** 3, 5 AND 9 REFERS TO THE NUMBER OF YEARS TAKEN TO REACH 100% EFFICIENCY

TABLE 3: FINANCIAL IMPACT OF CHANGES IN WATER COST

CRETERIA	P1 *				
	388 **	605.00	531.00	600.00	549
NPV @0%	182,101.30	181,918.80	134,911.30	180,995.80	128,971.30
NPV @3%	135,460.30	129,703.50	100,356.90	129,218.80	95,938.33
NPV @8%	89,394.85	79,580.38	66,228.93	79,477.25	63,312.94
B/C @0%	1.2412	1.2409	1.1682	1.2394	1.1596
B/C @3%	1.2412	1.2286	1.1682	1.2275	1.1596
B/C @8%	1.2412	1.2092	1.1682	1.2088	1.1596
AVG GR MARGIN	9,105.08	9,095.99	6,745.58	9,049.79	6,448.58
AVG RE MARGIN	9,105.08	9,095.99	6,745.58	9,049.79	6,448.58
IRR	24.1171	24.0872	18.8164	23.9356	15.9578
YEARS NEG GROSS MARGIN	0	0	0	0	0
	P2				
	388.00	605.00	531.00	600.00	549
NPV @0%	180,806.70	179,126.70	133,616.70	178,256.70	127,876.70
NPV @3%	135,262.70	128,337.30	100,058.80	127,892.70	95,627.53
NPV @8%	89,918.15	79,277.58	66,603.51	79,201.28	63,668.80
B/C @0%	1.2421	1.2393	1.1690	1.2379	1.1596
B/C @3%	1.2421	1.2277	1.1690	1.2267	1.1604
B/C @8%	1.2421	1.2095	1.1703	1.2092	1.1616
AVG GR MARGIN	9,040.34	8,958.34	6,680.84	8,912.84	6,383.84
AVG RE MARGIN	9,040.34	8,958.34	6,680.84	8,912.84	6,383.84
IRR	24.2115	23.9327	18.8289	23.7868	15.9614
YEARS NEG GROSS MARGIN	0.00	0	0	0	0
	S1		S2		
	485.00	508.00	485.00	508.00	
NPV @0%	118,705.50	108,455.50	116,547.50	106,400.00	
NPV @3%	88,301.90	80,877.20	87,230.05	79,659.98	
NPV @8%	56,273.40	53,241.80	58,023.08	53,009.82	
B/C @0%	1.2008	1.1803	1.2012	1.1808	
B/C @3%	1.2008	1.1803	1.2020	1.1813	
B/C @8%	1.2008	1.1803	1.2034	1.1826	
AVG GR MARGIN	5,935.28	5,422.78	5,827.38	5,320.00	
AVG RE MARGIN	5,935.28	5,422.78	5,827.38	5,320.00	
IRR	20.0762	18.0301	20.1242	18.0558	
YEARS NEG GROSS MARGIN	0.00	0	0.00	0.00	

* P1, P2, S1 AND S2 AS IN TABLE 1

** 388,00 ETCETERA REFERS TO WATER COST/CROPI/HA/ANNUM

TABLE 5: FINANCIAL IMPACT OF A PRICE-COST SQUEEZE OF 2.4% PER ANNUM

CRETERIA	P1		P2	
	RENT	BUY	RENT	BUY
	R150/ha	R1200/ha	R150/ha	R1200/ha
NPV @0%	(20,580.80)	(31,245.10)	(17,250.50)	(27,914.70)
NPV @3%	1,012.30	(8,347.86)	3,110.33	(6,249.83)
NPV @8%	16,852.25	9,131.28	18,043.49	10,322.52
B/C @0%	0.978511	0.967736	0.981742	0.970785
B/C @3%	1.001454	0.988167	1.004515	0.991049
B/C @8%	1.038023	1.020250	1.041035	1.023071
AVG GR MARGIN	(879.04)	(879.04)	(712.53)	(712.56)
AVG RE MARGIN	(1,029.04)	(1,562.04)	(882.53)	(1,395.74)
IRR	-2.1489	-3.2264	-1.8258	-2.9215
YEARS NEG GROSS MARGIN	10	10	11	11
CRETERIA	S1		S2	
	RENT	BUY	RENT	BUY
	R150/ha	R1200/ha	R150/ha	R1200/ha
NPV @0%	(40,859.60)	(47,907.70)	(37,720.30)	(44,968.40)
NPV @3%	(17,464.40)	(23,926.60)	(15,749.20)	(22,211.50)
NPV @8%	1,147.99	(4,274.55)	1,981.86	(3,460.68)
B/C @0%	0.945833	0.936788	0.948569	0.939286
B/C @3%	0.967990	0.956660	0.970547	0.958958
B/C @8%	1.003305	0.987884	1.005747	0.990020
AVG GR MARGIN	(1,882.98)	(1,882.98)	(1,736.01)	(1,736.01)
AVG RE MARGIN	(2,032.90)	(2,395.39)	(1,886.01)	(2,248.42)
IRR	-5.4167	-8.3212	-5.1431	-6.0714
YEARS NEG GROSS MARGIN	12	12	13	13

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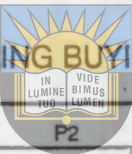
TABLE 6: FINANCIAL IMPACT FOR PREDICTION PURPOSES

CRETERIA	P2		S2	
	RENT	BUY	RENT	BUY
	R125/ha	R735/ha	R125/ha	R735/ha
NPV @0%	139,538.10	133,667.50	84,971.08	81,194.05
NPV @3%	96,895.50	91,654.14	57,989.75	54,524.44
NPV @8%	55,466.78	51,062.06	31,877.74	28,881.64
B/C @0%	1.188190	1.178856	1.147573	1.140095
B/C @3%	1.175781	1.164707	1.135458	1.126340
B/C @8%	1.153057	1.139210	1.113235	1.101512
AVG GR MARGIN	7,101.91	7,101.91	4,373.55	4,373.55
AVG RE MARGIN	6,976.91	6,683.37	4,248.55	4,059.70
IRR	18.8190	17.8857	14.7574	14.0095
YEARS NEG GROSS MARGIN	2	2	2	2

TABLE 6a: FINANCIAL IMPACT - COMPARING BUYING LAND WITH FREE LAND

CRITERIA	P2			S2		
	LAND FOR	BUY	BUY	LAND FOR	BUY	BUY
	FREE	R735/ha	R1200/ha	FREE	R735/ha	R1200/ha
NPV @0%	142,038.10	133,667.50	128,373.90	87,471.08	81,194.05	77,222.91
NPV @3%	98,755.19	91,654.14	87,163.41	59,849.44	54,524.44	51,155.60
NPV @8%	56,694.05	51,062.06	47,500.36	33,105.01	28,881.64	26,209.74
B/C @0%	1.192210	1.178856	1.170565	1.152578	1.140095	1.132336
B/C @3%	1.179762	1.164707	1.155383	1.140412	1.126340	1.117616
B/C @8%	1.156975	1.139210	1.128254	1.118110	1.101512	1.091264
AVG GR MARGIN	7,101.91	7,101.91	7,101.91	4,373.55	4,373.55	4,373.55
AVG RE MARGIN	7,101.91	6,683.37	6,418.69	4,373.55	4,059.70	3,861.15
IRR	19.220980	17.8857	17.0565	15.257780	14.0095	13.2336
YEARS NEG GROSS MARGIN	2	2	2	2	2	2

TABLE 6b: FINANCIAL IMPACT - COMPARING BUYING LAND WITH FREE LAND



CRITERIA	P2			S2		
	LAND FOR	BUY	BUY	LAND FOR	BUY	BUY
	FREE	R735/ha	R1200/ha	FREE	R735/ha	R1200/ha
NPV @0%	131,102.70	122,732.10	117,438.50	80,424.53	74,147.50	70,176.36
NPV @3%	90,836.23	83,735.18	79,244.45	54,744.98	49,419.98	46,051.14
NPV @8%	51,963.51	46,331.52	42,769.83	30,053.94	25,830.57	23,158.67
B/C @0%	1.190469	1.176166	1.167297	1.150569	1.137205	1.128909
B/C @3%	1.177051	1.160982	1.151044	1.137491	1.122479	1.113185
B/C @8%	1.152908	1.134112	1.122539	1.113929	1.096376	1.085554
AVG GR MARGIN	6,555.14	6,555.14	6,555.14	4,021.23	4,021.23	4,021.23
AVG RE MARGIN	6,555.14	6,136.60	5,871.92	4,021.23	3,707.38	3,508.82
IRR	19.046940	17.6166	16.7297	15.056890	13.7205	12.8909
YEARS NEG GROSS MARGIN	2	2	2	2	2	2

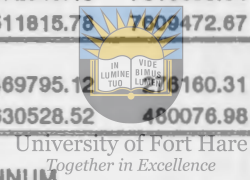
50% WATER RESTRICTION IN YEARS 10, 11 AND 12

TABLE 7: FINANCIAL IMPACT FOR THE TOTAL FARMING AREA OF THE TAUNG IRRIGATION SCHEME

CRITERIA	P2		S2		TOTAL	
	RENT	BUY	RENT	BUY	RENT	BUY
	R125/ha	R735/ha	R125/ha	R735/ha	R125/ha	R735/ha
NPV @0%	35,079,878.34	33,804,009.50	12,179,188.13	11,837,813.83	47,259,088.47	45,241,823.33
NPV @3%	24,359,528.70	23,041,850.80	8,311,884.17	7,815,189.73	32,671,392.87	30,857,020.53
NPV @8%	13,944,348.49	12,837,001.88	4,569,142.73	4,139,701.73	18,513,491.23	16,976,703.62
B/C @0%	1.188190	1.178856	1.147573	1.140095	1.178024	1.167246
B/C @3%	1.175781	1.164707	1.135458	1.126340	1.163703	1.153215
B/C @8%	1.153057	1.139210	1.113235	1.101512	1.141129	1.127918
AVG GR MARGIN	1,785,418.92	1,785,418.92	826,876.07	826,876.07	2,412,294.99	2,412,294.99
AVG RE MARGIN	1,753,983.92	1,680,200.22	608,959.41	581,890.62	2,362,953.32	2,282,090.84
IRR	18.8190	17.8857	14.7574	14.0095	17.80	16.72

TABLE 8: FARM FINANCIAL ANALYSIS FOR THE TOTAL IRRIGATION AREA

YEARS	1	2	3	4	5	6	7	8	9	10
INCOME										
RENT *	11428229.53	5662684.76	19060328.43	17142344.30	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22
BUY *	11428229.53	5662684.76	19060328.43	17142344.30	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22
PRODUCTION COST										
RENT	13265692.51	7052526.64	18673172.43	14223927.30	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90
BUY	13265692.51	7052526.64	18673172.43	14223927.30	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90
COST OF LAND										
RENT	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88
BUY	468778.31	398461.56	338692.33	287888.48	244705.21	207999.43	176799.51	150279.59	127737.65	108577.00
TOTAL COST										
RENT	13714314.38	7501148.51	19121794.31	14672549.18	7813389.34	20014013.49	14991960.77	7813389.34	20014013.49	14991960.77
BUY	13734470.82	7450988.20	19011864.76	14511815.78	7609472.67	19773391.04	14720138.41	7515047.05	19693129.26	14651915.90
RETAINABLE INCOME										
RENT	-2286084.85	-1838463.76	-61465.88	2469795.12	276160.31	3811397.05	4055088.45	276160.31	3811397.05	4055088.45
BUY	-2306241.29	-1788303.44	48463.67	2630528.52	460078.98	4052019.50	4326910.81	574502.60	4132281.27	4395133.32



* LAND IS RENTED AT R125/HA/ANNUM OR BOUGHT AT R735/HA/ANNUM

TABLE 8: (CONTINUE)

YEARS	11	12	13	14	15	16	17	18	19	20
INCOME										
RENT	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22	8089549.65
BUY	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22	8089549.65	23825410.54	19047049.22	8089549.65
PRODUCTION COST										
RENT	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90	7364767.46
BUY	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90	7364767.46	19565391.62	14543338.90	7364767.46
COST OF LAND										
RENT	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88	448621.88
BUY	92290.45	76446.88	66679.85	58677.87	48178.19	40949.76	34807.30	29586.20	25148.27	21376.03
TOTAL COST										
RENT	7813389.34	20014013.49	14991960.77	7813389.34	20014013.49	14991960.77	7813389.34	20014013.49	14991960.77	7813389.34
BUY	7457057.91	19643838.50	14610018.75	7421445.33	19613567.81	14584288.66	7399574.76	19591977.82	14568487.17	7386143.49
RETAINABLE INCOME										
RENT	276160.31	3811397.05	4055088.45	276160.31	3811397.05	4055088.45	276160.31	3811397.05	4055088.45	276160.31
BUY	632491.74	4181572.04	4437030.47	668104.32	4211842.73	4462760.56	689974.89	4230432.72	4478562.05	703406.16

TABLE 9: PRELIMINARY BENEFIT/COST ANALYSIS FOR RESTRUCTURING THE TAUNG IRRIGATION SCHEME

YEARS	BENEFIT	COST				TOTAL COST
	INCOME TO FARMERS	FARM EXPENSES	GOVERNMENT EXPENSES TO			
		FARMING PRODUCTION EXPENSES	CO-OP	AGRIBANK	AGRICOR	
1	11,428,229.53	13,265,692.51	1,500,000.00	1,057,500.00	8,000,000.00	23,823,192.51
2	5,662,684.78	7,052,528.64	1,125,000.00	382,500.00	8,000,000.00	16,560,026.64
3	19,060,328.43	18,673,172.43	750,000.00	382,500.00	8,000,000.00	27,805,672.43
4	17,142,344.30	14,223,927.30	375,000.00	382,500.00	8,000,000.00	22,981,427.30
5	8,089,549.65	7,364,787.46	0.00	382,500.00	8,000,000.00	15,747,267.46
6	23,825,410.54	19,565,391.62	0.00	382,500.00	5,400,000.00	25,347,891.62
7	19,047,049.22	14,543,338.90	0.00	382,500.00	5,400,000.00	20,325,838.90
8	8,089,549.65	7,364,787.46	0.00	382,500.00	5,400,000.00	13,147,267.46
9	23,825,410.54	19,565,391.62	0.00	382,500.00	5,400,000.00	25,347,891.62
10	19,047,049.22	14,543,338.90	0.00	382,500.00	5,400,000.00	20,325,838.90
11	8,089,549.65	7,364,787.46	0.00	382,500.00	5,400,000.00	13,147,267.46
12	23,825,410.54	19,565,391.62	0.00	382,500.00	5,400,000.00	25,347,891.62
13	19,047,049.22	14,543,338.90	0.00	382,500.00	5,400,000.00	20,325,838.90
14	8,089,549.65	7,364,787.46	0.00	382,500.00	5,400,000.00	13,147,267.46
15	23,825,410.54	19,565,391.62	0.00	382,500.00	5,400,000.00	25,347,891.62
16	19,047,049.22	14,543,338.90	0.00	382,500.00	5,400,000.00	20,325,838.90
17	8,089,549.65	7,364,787.46	0.00	382,500.00	5,400,000.00	13,147,267.46
18	23,825,410.54	19,565,391.62	0.00	382,500.00	5,400,000.00	25,347,891.62
19	19,047,049.22	14,543,338.90	0.00	382,500.00	5,400,000.00	20,325,838.90
20	8,089,549.65	7,364,787.46	0.00	382,500.00	5,400,000.00	13,147,267.46
TOTAL	316,193,183.72	267,947,576.20	3,750,000.00	8,325,000.00	121,000,000.00	401,022,576.20

NPV @ 0% (84,829,392.48)
 NPV @ 3% (68,722,572.85)
 NPV @ 8% (52,006,064.91)
 IRR -21.153271

B/C @ 0% 0.788467
 B/C @ 3% 0.771938
 B/C @ 8% 0.742513



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TABLE 10: FISCAL IMPACT (R) FOR RESTRUCTURING THE IRRIGATION SCHEME

YEARS	GOVERNMENT EXPENSES TO				TOTAL COST
	FARMERS	CO-OP	AGRIBANK	AGRICOR	
1	4,342,030	1,500,000	1,057,500	8,000,000	14,899,530
2	3,947,300	1,125,000	382,500	8,000,000	13,454,800
3	2,116,980	750,000	382,500	8,000,000	11,249,480
4	143,330	375,000	382,500	8,000,000	8,900,830
5	1,722,250	0	382,500	8,000,000	10,104,750
6	0	0	382,500	5,400,000	5,782,500
7	0	0	382,500	5,400,000	5,782,500
8	0	0	382,500	5,400,000	5,782,500
9	0	0	382,500	5,400,000	5,782,500
10	0	0	382,500	5,400,000	5,782,500
11	0	0	382,500	5,400,000	5,782,500
12	0	0	382,500	5,400,000	5,782,500
13	0	0	382,500	5,400,000	5,782,500
14	0	0	382,500	5,400,000	5,782,500
15	0	0	382,500	5,400,000	5,782,500
16	0	0	382,500	5,400,000	5,782,500
17	0	0	382,500	5,400,000	5,782,500
18	0	0	382,500	5,400,000	5,782,500
19	0	0	382,500	5,400,000	5,782,500
20	0	0	382,500	5,400,000	5,782,500
TOTAL	12,271,890	3,750,000	8,325,000	121,000,000	145,346,890