

Creating sustainable smallholder irrigated farm businesses

**Proceedings of a workshop held at
Hoedspruit, Northern Province, South
Africa**

June 25-29, 2001

**OD/TN108
September 2001**

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Contract - Research

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Summary

This document gives an account of the proceedings of the workshop ‘Creating sustainable smallholder irrigated farm businesses’ which was funded by DFID as part of KAR project R7810 of the same name. The objective of this workshop was to identify the needs of the smallholder irrigation community in the region for research to assist in improving the capacity of smallholders to run sustainable businesses and to identify policy options that would promote success and innovation. Investigations made in fifteen schemes in the region suggest that on average the returns to smallholder irrigation are lower than predicted, that schemes as opposed to individuals lack clear objectives which limits their effectiveness and that farmers lack information and ready market access. In virtually all the schemes marketing was identified as the key constraint although generally not the only constraint.

The account provides summaries of the working group responses to questions arising from discussion papers presented in the sessions. These discussion papers are provided in this document. Descriptions of the fifteen irrigation schemes investigated in the preliminary phase of the research were provided for participants in the Workshop folders. Tabular summaries of these findings are presented within this document.

The final section of the document presents the broad research needs identified in the workshop. In addition this section has benefited from the expressed interests of the Northern Province Department of Agriculture (South Africa) in relation to research. Finally the bare bones of a programme that might address some of the issues is presented.

We would like to thank all the participants who gave time to comment on the draft version. All comments have been taken into account although they may not appear in the exact form in which they were originally submitted due to the need to take a consensus of comments received.

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1. INTRODUCTION

Investigation of smallholder irrigation indicates that farmers ability to grow crops is constrained by lack of cash for inputs and maintenance costs. This problem to some extent arises from the difficulty faced by the smallholders in finding markets for their produce: exacerbated in some cases by production of poor quality produce which does not attract buyers in a competitive market.

There are other, fundamental, causes for marketing difficulty associated with the way in which smallholder irrigation schemes were originally set up. The initial objective of many existing schemes was a political rather than economic. Many schemes were situated in remote areas and served to assist in the resettlement of people in new, less agriculturally attractive areas. More recently established schemes were initiated to improve living standards of rural dwellers, to provide food security. These welfare functions were heavily subsidised by the state not only in the form of capital costs but in the recurrent costs of operation and maintenance and the staff costs associated with management and training.

Governments can no longer afford this level of subsidy and are steadily withdrawing support, devolving costs to farmers. These farmers naturally face escalating costs and must develop strategies to restructure their businesses to make them sustainable in the long run. They are hampered in their efforts by lack of links with the commercial sector and by the scattered small nature of smallholder developments often poorly served by road and rail infrastructure making the transport of perishable produce expensive and risky. The surrounding local population is seldom sufficiently affluent to provide consistent high demand that would relieve irrigators from having to market over distances. Lack of information and lack of training in business methods further hamper them. Nonetheless irrigators are keen to improve the viability and profitability of their businesses.

Another fundamental problem for smallholders is having to co-operate with fellow irrigators to source and share water, while competing with them in selling produce. Where should the line be drawn between these spheres and what is the impact of change on the sustainability and performance of the schemes in meeting the needs of farmers? Individuals, families, groups, and committees have to take decisions that give actions direction and value. In many ways it is illustrated that individuals are clear about their objectives whereas 'scheme committees' are not. Many farmers avoid group decisions for reasons of low trust. Institutional arrangements to foster trust are often inadequate.

It is also important that communities as a whole are party to the decision making processes for they too are stakeholders in the business viability of the irrigators although they are not always recognised as such.

The workshop discussions take place with these fundamental issues in mind.

2. OPENING SESSION

The workshop opened with a very warm welcome to everyone and thanks for the enthusiasm people have shown in turning out in such large numbers. The organisers appreciate the effort that goes into attending such a workshop and hope that all fifty-five participants will leave with new experiences and approaches to consider in relation to their own part in smallholder irrigation development.

The researchers, many of whom are outsiders, are not here to criticise, judge or tell anyone what to do: they are aware that many issues identified by investigation so far are already being addressed. The intention is to offer assistance, to help identify gaps in knowledge and look at ways in which research can help both those who are developing and implementing policies and farmers who are selecting technologies, developing businesses and establishing commercial links.

It is hoped that the workshop can be of assistance in bringing people together from the three countries participating in the research to exchange and share experiences. If our research contribution can be defined so that it is a useful contribution to the work that is already going on in the southern African region, then our objectives will be met.

We are pleased to welcome four main groups: those who contribute from the government departments and agencies in South Africa, Swaziland and Zimbabwe; those who farm on smallholder irrigation systems in South Africa and Swaziland; those NGO staff, consultants and companies who work in irrigation development and the researchers themselves. The researchers include individuals from HR Wallingford and Reading University in the UK, Institute of Agricultural Engineering in South Africa, Ministry of Agriculture, Royal Swazi Sugar Corporation, and NAMBOARD in Swaziland and CARE and AGRITEX in Zimbabwe. Between them they represent social, participatory, economic, institutional, agricultural and engineering backgrounds as they are applied to smallholder irrigation.

What we present to you as a basis of discussion is the output from what has been done so far. That is a brief investigation of 15 smallholder schemes in the region, through background information gathering, a brief survey of a sample group of farmers at each scheme and a series of focus group discussions at a few schemes. The collection of data has been difficult in some ways and this in itself signals that insufficient information is available or is forthcoming. Clearly lack of information limits the capacity of schemes or groups to make effective plans and decisions. It is the impact of this type of limitation that we will explore in the days to come. Our findings will be detailed in a later session, but to provide an introductory comment the strong impression is of enormous change in the irrigation sector in the region from one where top-down management prevailed to one in which irrigators must decide and provide for themselves. There are huge challenges facing the farmers and professionals alike. This workshop provides an opportunity to work together towards solutions.

3. THE STUDY'S FINDINGS TO-DATE

3.1 A background to irrigation in the study area

The session opened with the following paper on the background to irrigated agriculture in the study area.

Background paper on irrigated agriculture in South Africa, Swaziland and Zimbabwe

Introduction: In all three countries included in this study, the Republic of South Africa, Swaziland and Zimbabwe, smallholder irrigation is seen as an important component of agricultural and rural development.

The historical backgrounds differ between the three countries, not least in the substantial time lags in achieving democratic majority self-determination, between Swaziland the first and South Africa the last. There are also significant differences in the structure of the national and the agricultural economies (see Table 1).

Table 1 Some features of the national and agricultural economies of the three Countries

	South Africa	Swaziland	Zimbabwe
GNP per capita \$(PPP)	7,190	4,200	2,240
Agriculture as % of GDP	5	10	19
Agricultural popl'n as % of total	15	34	63
Agricultural land per 100 rural popl'n (ha)	1,670	390	280
Irrigated land per 100 rural popl'n (ha)	22.7	20.5	1.6
Irrigated land as prop'n of all agric. %	1.35	5.19	0.57

South Africa has a much higher National Income per capita than the other countries but with agriculture making a much smaller contribution to the total. (It should be noted that in all countries, the food industry, which depends on agriculture, employs a larger percentage of the population). The rural resource base, in terms of hectares of agricultural land and hectares of irrigated land per head of the rural population appears highest in South Africa and lowest in Zimbabwe. Swaziland has the highest proportion of agricultural land under irrigation.

These national estimates provide little guidance, however, as to the average resource base of smallholder farmers, in particular since substantial areas are devoted to large-scale commercial farming in all three countries. Furthermore big differences are likely between regions within countries. The South Africa component is limited to Northern Province.

Despite the large historical economic and resource differences between the three countries, each of the National Governments is committed to the promotion of smallholder irrigation, with increased farmer participation in the operation and management of schemes. Further information on policies and projects is presented below country by country.

South Africa

In South Africa small-scale irrigation has a long tradition, particularly over the last century. Several large irrigation projects were established to serve white farmers, while since 1940 the Government established several large schemes in the former Bantustans, to promote economic growth and development. However, most were focussed on the production of staple foods (maize and wheat) with the aim of achieving local food self-sufficiency and were subject to external management with little or no community participation. More recently some schemes were adapted to settle project farmers under central management (Mpahlele, Malakalaka & Hedden-Dunkhorst 2000).

Following the return to majority rule in 1994, government support, in terms of credit and service provision has been reduced substantially. The centrally managed and government supported projects have been

turned over to farmer participation in project control and management. The policy objective is to promote irrigated farming as an element of agricultural development, whilst increasingly devolving decision-making responsibility to the farmers. New support services are being designed and implemented. Three of the schemes being studied, Strydkraal, Thabina and Dingleydale, are all of this nature. The fourth scheme though launched with the aid of an NGO (the Rural women's Association) is now effectively managed by the farmers themselves.

The aims of agricultural development, recently set out by the **Director General of the Ministry of Agriculture** are to facilitate economic growth by raising yields and incomes at the same time as satisfying food security at the household level, on a sustainable basis. "Linked to that of course is the economic and entrepreneurial character which African agriculture needs to take on". Within this context, there are many agencies involved in encouraging and improving farmer participation in the management of smallholder irrigation schemes (e.g. Agricultural Research Council, Water Research Commission, MBB Consulting Engineers, Loxton-Venn & Associates).

Swaziland

Sugar is regarded as Swaziland's most valuable export. Until the advent of the Simunye Estate and Mill, companies outside Swaziland carried out all development. Swazi smallholder involvement started in 1962 with the establishment of Vuvulane Irrigated Farms, which today involves 260 smallholders. Estates and mills such as Simunye have started to encourage smallholder out-grower production.

The Komati Basin Development Project was conceived in the early 1980s to provide irrigation water for farm development in South Africa and Swaziland. In Swaziland this involves the construction of the Maguga Dam, the development of 7,400 hectares of smallholder irrigated farms downstream and the expansion of a sugar mill to accommodate an additional 80,000 tonnes of sugar annually. The project is administered and implemented on behalf of the Swaziland Government by the Swaziland Komati Project Enterprise (SKPE). This scheme was not included in our survey but its development serves to illustrate the importance given to smallholder sugar production, in agricultural expansion and the alleviation of rural poverty.

However, there is a National debate in progress, regarding the possible dangers of becoming too highly dependent on sugar alone. The Government of Swaziland is already promoting smallholder vegetable production under irrigation, in the Malkerns Valley and elsewhere.

Zimbabwe

Zimbabwe's agricultural sector is a major contributor to national food security, foreign currency earnings from exports, employment and industrial raw materials. Historically, large-scale commercial farms benefited from public investment and the provision of government support services. The recently launched Zimbabwe Agricultural Policy Framework (ZAPF) is aimed at redressing the balance and improving productivity and incomes among smallholder farmers. This now incorporates the National Irrigation Policy and Strategy (NIPS).

Irrigation has contributed to agricultural growth from the early 1950s, but after independence the Government intensified its efforts to promote irrigation development among smallholders. Initially it was justified, in many cases, on social welfare grounds, but more recently economic problems and the Structural Adjustment Programme have led to reduction or removal of subsidies and the need for irrigated agriculture to become self-supporting. The development of the Water Resources Management Strategy (WRMS) is expected to improve access to irrigation water for smallholders and increase their participation in planning water resources and promoting more equitable distribution of water rights than in the past. National policy objectives include:

1. Growth in the irrigated area particularly in the smallholder sector with minimal negative impacts on the environment and human health;

2. Equitable allocation and efficient use of water resources;
3. Establishing a water pricing structure which is consistent with cost and social efficiency;
4. Establishing an effective institutional structure; and
5. Implementing efficient drought mitigating strategies.

Strategies to be followed in implementing these policies include:

1. Priority to be placed on farmer-managed and operated systems. Government will assist in development and farmers will retain responsibility for operation and maintenance (O & M) of irrigation systems;
2. Effective water user's associations will be encouraged and facilitated;
3. Institutional capacity for development will be encouraged in both the public and private sectors. Within the public sector, better co-ordination will be achieved particularly between Agritex (the Agricultural Extension Service) and the Department of Water Resources (DWR), (Republic of Zimbabwe 1998).

Between 1912 and 1980, 74 smallholder schemes were established, ranging in size from 2 ha to 400 ha. Since independence many more have been created, although some have ceased operation because of siltation and other problems. Today there are now over 300 smallholder schemes. Apart from government support provided by Agritex, donors such as Danida, KFW (German Aid), and NGOs such as CARE International, have been involved in smallholder irrigation development. FAO/UNDP have also provided support, mainly in training.

Problems identified include:

- a) Excessive Government control;
- b) Unprofitable production;
- c) Farmers' reluctance to pay water charges;
- d) High development costs;
- e) Lack of farmer participation;
- f) Changing and uncertain objectives;
- g) Too many Government institutions involved.

In summary, it appears that, despite differences between nations, in the historical background and the individual development of schemes, they are all attempting to promote the development and improvement of smallholder irrigation, and face similar problems in promoting that development.

3.2 The data obtained from initial field surveys

To facilitate comparison of the fifteen study schemes, five summary tables were produced using data from the surveys, background information from country key informants, other secondary data sources and also our own impressions from visiting selected schemes. Scheme data have been sorted by: *Country, Plot size, Commercial activity, Key constraint and Management style*

There are still gaps in the tables where there is not as yet sufficient information, or where there is uncertainty about the reliability of the data (partly due to survey method and partly to farmers' lack of clear data on their own activities).

Table 2 Schemes sorted by country

	South Africa				Zimbabwe							Swaziland			
	Thabina	Dingleydale	Apel	Strykraal	Deure	Tawona	Wenimbi	Negomo	Garl	Tsviyo	Chendeubu	Mbekelweni	Ntambuphi	Lilanda	Maplotini
BACKGROUND															
Local population density (High/med/Low)	H	H	H	H	?	?	?	?	M	M	M	?	?	?	M
Roads and railways (Good/Poor)	G	G	P	G	G	P	G	G	P	P	P	?	?	P	G
Rainfall (mm/annum)	700	600	400	400	4-500	4-500	8-900	750-1000	?	?	?	800?	800?	800?	800?
Frost free (Yes / No)	Y	Y	N	N	Y	Y	N	?	N	?	?	?	?	?	?
Access to rainfed land (Yes/No/Some)	N	Y	N	S	N	Y	Y	Y	Y	?	Y	?	?	M	?
INFRASTRUCTURE															
Scheme size (ha)	220ha	1650ha	22.8ha	338ha	302	165	36	360	?	?	?	?	?	42	71 (veg)
Average plot size (ha)	2.2	3	0.08 ²	1.2	0.8	0.8	1.6	1.2	?	?	?	0.4	0.4	1.5	N/A
No. of plot holders	143	1200	300	256	423	264	22	296	87	56	168	?	?	14	71
Water reliability (Good, Satisfactory, Poor)	S	S	P	S	S	P	G ³	G	G	G	G	?	?	G	G
Pumped / Gravity	P/G	G	P	P	G	P	P	P	G	G	G	?	?	P	P
Surface / Sprinkler / Drip/Buckets	S	S	S	S	S ⁴	S	Sp	Sp	B	B	B	?	?	Sp	D
Age of scheme (years)	40	41	9	50+	55	49	10	5	3	10	3	?	?	2	2
INSTITUTIONAL															
Management (Farmer / Agency / NGO / Private)	F/A	F/A	F	F/A	A	A	F	A	F/NGO	F/NGO	F/NGO	?	?	F/P	P
Cost recovery (High / Low)	?	?	H	?	?	?	H	L	H	H	H	?	?	H	H
Commercial links (Good/Average/Poor)	A	A	P	P	P	P	P	G	?	?	?	?	?	G	G
Support services (Good, Average, Poor)	G	G	P	P	A	A	A	G	G	G	G	?	?	G	G
Training available (Good / Poor)	G	G	P	P	P	P	G	G	G	G	G?	?	?	G	G
PRODUCTION & INCOME															
Main irrigated crop (summer)	Maize	Maize	Maize	Maize	Maize	Maize	Maize	Cotton	Sugarcane ¹	Tomatoes	?	Maize	Maize	Sugarcane	Veg
Main irrigated crop (winter)	Veg	Veg	Veg	Veg/wheat	Beans	Tom	Veg	Citrus	Sugarcane ¹	?	?	Cabbage	Cabbage	Sugarcane	Veg
Significant rainfed contribution	N	N	N	N	N	?	Y	N	Y	Y	Y	N	N	Y	Y
% Cropping intensity (summer)	100%	61%	90%	70%	100	90	84	89	50% ²	?	?	?	?	100% ²	100%
% Cropping intensity (winter)	?	20% ²	?	?	100	80	27	33	50% ²	?	?	?	?	100% ²	100%
Average income from Irrigation (summer)		2,180	1,100	1,600	1,414	2,600	15,171	4,057	427	393	214	900E	1,200E	?	
Average income from Irrigation (winter)	3,532	900	460	1,500	2,557	1,814	3,257	1,700	512	579	206	1,000E	1,500E	?	16,000E
Average income from rainfed production	0	0	0	0	?	?	?	?	1,100	2,357	586	?	?	?	13000E
Average income from other sources	4,750	6,170	2,000	880	?	1,586	1,429	286	467	1,047	950	1,100E	700E	5,125E	10,000E
MARKETING															
Do farmers sell to local markets?	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Do farmers sell to distant markets?	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Active marketing groups for irrigation	N	N	N	N	N	Y	Y	?	N ²	N	Y	Y	Y	N	N
Proportion of maize crops sold (RF = Rainfed, GM=Green Mealie)	50%	20%	1%	50%	34%	62%	50%	44%	70%(GM)	>70%(GM)	?	80 (GM)%	60%	20% (RF)	?
Proportion of vegetables sold	60%	>60%	>60%	60%	>80%	>80%	>80%	80%	>60%	>60%	?	90%	100%	60%	100%
Proportion of cash crops sold	NA	NA	NA	100%	>50%	50%	65%	70%	70%	NA	?	?	?	100%	100%
Current use of contracts & GAs (Minimal/Widespread/None)	M	M	N	M	M	W	M	W	N	N	N	M	M	M	W
Processing & packaging (Minimal/Widespread/Some/None)	S	S	S	S	N	N	S	S	M	M	M	N	M	M	N
Grading & cleaning (Minimal/Widespread/Some/None)	M	M	S	S	M	M	M	M	M	M	M	M	S	M	W
Advertising (Minimal/Widespread/ Some / None)	S	S	N	N	N	S	N	N	M	M	M	N	N	N	N
CONSTRAINTS															
Transport (High / Medium / Low / No)	M	M	H	M	H	H	H	H	H	H?	H	M	H	M	N
Water (High / Medium / Low / No)	M	M	H	M	M	M	M	L	L	N	L	?	?	M	N
Market glut (High / Medium / Low / No)	M	L	N	M	M	?	L	L	L	L	L	H	H	N	N
Lack of co-operation between farmers (High / Medium / Low)	L	M	L	M	?	?	L	L	L	L	L?	H	?	?	N
Credit (High / Medium / Low / No)	L	M	M	L	L	L	L	L	L	H	H	M	?	L	N
Cost of inputs (High / Medium / Low / No)	L	L	H	L	H	H	M	H	L	?	?	?	M	?	N
Availability of inputs (High / Medium / Low / No)	L	L	H	L	M	H	L	L	L	L	L	?	?	N	N
Ploughing (High/Medium/Low/None)	H			H	?	?	M	?	NA	N/A	N/A	?	?	?	N
Key constraint (M= Market, T=Transport, W=Water, C=Credit)	M	M	W	MT	?	?	T	?	MT	CT	CT	M	M/T	?	Contract terms

Notes: 1. Sugarcane is grown all year on a third of the land. Tomato is the second crop
 2. Average for maize plot = 0.07ha, average for vegetable garden = 0.01
 3. Water is limited in the winter
 4. Sprinkler being introduced on one section

Table 3 Schemes sorted by plot size

	Plots < 0.9ha						Plots 0.5 - 1.9ha				Plots > 1.5ha				
	Apel (SA)	Gari (ZIM)	Tsviyo (ZIM)	Chendebyu (ZIM)	Mbekweni (SW)	Ntamkuphi (SW)	Deure (ZIM)	Tawona (ZIM)	Negomo (ZIM)	Strydakraal (SA)	Thabina (SA)	Dingleydale (SA)	Wentimbi (ZIM)	Lilanda (SW)	Maplotini (SW)
BACKGROUND															
Local population density (High/med/low)	H	M	M	M	?	?	?	?	?	H	H	H	?	?	M
Roads and railways (Good/Poor)	P	P	P	P	?	?	G	P	G	G	G	G	G	P	G
Rainfall (mm/annum)	400	?	?	?	800?	800?	4-500	4-500	750-1000	400	700	600	8-900	800?	800?
Frost free (Yes/Nb)	N	N	?	?	?	?	Y	Y	?	N	Y	Y	N	?	?
Access to rainfed land (Yes/No/Some)	N	Y	?	Y	?	?	N	Y	Y	S	N	Y	Y	M	?
INFRASTRUCTURE															
Scheme size (ha)	228ha	?	?	?	?	?	302	165	360	338ha	220ha	1650ha	36	42	71 (veg)
Average plot size (ha)	0.08 ²	?	?	?	0.4	0.4	0.8	0.8	1.2	1.2	2.2	3	1.6	1.5	N/A
Nb of plot holders	300	87	56	168	?	?	423	264	296	256	143	1200	22	14	71
Water reliability (Good, Satisfactory, Poor)	P	G	G	G	?	?	S	P	G	S	S	S	G ¹	G	G
Pumped / Gravity	P	G	G	G	?	?	G	P	P	P	P/G	G	P	P	P
Surface / Sprinkler / Drip/Buckets	S	B	B	B	?	?	S ¹	S	Sp	S	S	S	Sp	Sp	D
Age of scheme (years)	9	3	10	3	?	?	55	49	5	50+	40	41	10	2	2
INSTITUTIONAL															
Management (Farmer / Agency / NGO / Private)	F	F/NGO	F/NGO	F/NGO	?	?	A	A	A	FA	F/A	F/A	F	F/P	P
Cost recovery (High/Low)	H	H	H	H	?	?	?	?	L	?	?	?	H	H	H
Commercial links (Good/Average/Poor)	P	?	?	?	?	?	P	P	G	P	A	A	P	G	G
Support services (Good, Average, Poor)	P	G	G	G	?	?	A	A	G	P	G	G	A	G	G
Training available (Good / Poor)	P	G	G	G	?	?	P	P	G	P	G	G	G	G	G
PRODUCTION & INCOME															
Main irrigated crop (summer)	Mize	Sugarcane ¹	Tomatoes	?	Mize	Mize	Mize	Mize	Cotton	Mize	Mize	Mize	Mize	Sugarcane	Veg
Main irrigated crop (winter)	Veg	Sugarcane ¹	?	?	Gibbage	Gibbage	Beans	Tom	Citrus	Veg/wheat	Veg	Veg	Veg	Sugarcane	Veg
Significant rainfed contribution	N	Y	Y	Y	N	N	N	?	N	N	N	N	Y	Y	Y
% Cropping intensity (summer)	90%	50%/2	?	?	?	?	100	90	89	70%	100%	61%	84	100%/2	100%
% Cropping intensity (winter)		50%/2	?	?	?	?	100	80	33	?	?	20%/2	27	100%/2	100%
Average income from irrigation (summer)	1100	427	393	214	900E	1,200E	1,414	2,600	4,057	1,600		2,180	15,171	?	
Average income from irrigation (winter)	460	512	579	206	1,000E	1,500E	2,557	1,814	1,700	1500	3,532	900	3,257	?	16,000E
Average income from rainfed production	0	1,100	2,357	586	?	?	?	?	?	0	0	0	?	?	13,000E
Average income from other sources	2,000	467	1,047	950	1,100E	700E	?	1,586	286	880	4,750	6,170	1,429	5,125E	10,000E
MARKETING															
Do farmers sell to local markets?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Do farmers sell to distant markets?	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y
Active marketing groups for irrigation	N	N ²	N	Y	Y	Y	N	Y	?	N	N	N	Y	N	N
Proportion of maize crops sold (FF = Rainfed, GV=Green Maize)	1%	70%(GM)	>70%(GM)	?	80 (GM)%	60%	34%	62%	44%	50%	50%	20%	30%	20%(FF)	?
Proportion of vegetables sold	>60%	>60%	>60%	?	90%	100%	>80%	>80%	80%	60%	60%	>60%	>80%	60%	100%
Proportion of cash crops sold	NA	70%	NA	?	?	?	>50%	50%	70%	100%	NA	NA	6%	100%	100%
Current use of contracts & GAs (Minimal/Widespread/None)	N	N	N	N	M	M	M	W	W	M	M	M	M	M	W
Processing & packaging (Minimal/Widespread/Some/None)	S	M	M	M	N	M	N	N	S	S	S	S	S	M	N
Grading & cleaning (Minimal/Widespread/Some/None)	S	M	M	M	M	S	M	M	M	S	M	M	M	M	W
Advertising (Minimal/Widespread / Some / None)	N	M	M	M	N	N	N	S	N	N	S	S	N	N	N
CONSTRAINTS															
Transport (High / Medium / Low / Nb)	H	H	HP	H	M	H	H	H	H	M	M	M	H	M	N
Water (High / Medium / Low / Nb)	H	L	N	L	?	?	M	M	L	M	M	M	M	M	N
Market glut (High / Medium / Low / Nb)	N	L	L	L	H	H	M	?	L	M	M	L	L	N	N
Lack of co-operation between farmers (High / Medium / Low)	L	L	L	L ²	H	?	?	?	L	M	L	M	L	?	N
Credit (High / Medium / Low / Nb)	M	L	H	H	M	?	L	L	L	L	L	M	L	L	N
Cost of inputs (High / Medium / Low / Nb)	H	L	?	?	?	M	H	H	H	L	L	L	M	?	N
Availability of inputs (High / Medium / Low / Nb)	H	L	L	L	?	?	M	H	L	L	L	L	L	N	N
Ploughing (High / Medium / Low / None)		NA	NA	NA	?	?	?	?	?	H	H	M	M	?	N
Key constraint (M=Market, T=Transport, W=Water, C=Credit)	W	MT	CT	CT	M	MT	?	?	?	MT	M	M	T	?	Contract terms

Table 4 Schemes sorted by degree of commercialisation

	Highly commercial				Moderately commercial			Minimally commercial						Unknown	
	Wenimbi (ZIM)	Negomo (ZIM)	Lilanda (SW)	Maplotini (SW)	Thabina (SA)	Dingleydale (SA)	Deure (ZIM)	Tawona (ZIM)	Gari (ZIM)	Tsvlyo (ZIM)	Chendebevu (ZIM)	Apel (SA)	Strydkraal (SA)	Mbakekwini (SW)	Ntambuphi (SW)
BACKGROUND															
Local population density (High/med/low)	?	?	?	M	H	H	?	?	M	M	M	H	H	?	?
Roads and railways (Good/Poor)	G	G	P	G	G	G	G	P	P	P	P	P	G	?	?
Rainfall (mm/annum)	8-900	750-1000	?	?	700	600	4-500	4-500	?	?	?	400	400	?	?
Frost free (Yes/ No)	N	?	?	?	Y	Y	Y	Y	N	?	?	N	N	?	?
Access to rainfed land (Yes/No/Some)	Y	Y	M	?	N	Y	N	Y	Y	?	Y	N	S	?	?
INFRASTRUCTURE															
Scheme size (ha)	36	360	42	71 (veg)	220ha	1630ha	302	165	?	?	?	22.8ha	338ha	?	?
Average plot size (ha)	1.6	1.2	1.5	NA	2.2ha	3ha	0.8	0.8	?	?	?	0.08ha ²	1.2ha	0.4	0.4
No. of plot holders	22	296	14	71	143	1200	423	264	87	56	168	300	256	?	?
Water reliability (Good, Satisfactory, Poor)	G ³	G	G	G	S	S	S	P	G	G	G	P	S	?	?
Pumped/ Gravity	P	P	P	P	PG	G	G	P	G	G	G	P	P	?	?
Surface/ Sprinkler/ Drip/Buckets	Sp	Sp	Sp	D	S	S	S ⁴	S	B	B	B	S	S	?	?
Age of scheme (years)	10	5	2	2	40	41	55	49	3	10	3	9	50+	?	?
INSTITUTIONAL															
Management (Farmer/ Agency/ NGO/ Private)	F	A	FP	P	F/A	F/A	A	A	F/NGO	F/NGO	F/NGO	F	F/A	?	?
Cost recovery (High/ Low)	H	L	H	H	?	?	?	?	H	H	H	H	?	?	?
Commercial links (Good/Average/Poor)	P	G	G	G	A	A	P	P	?	?	?	P	P	?	?
Support services (Good, Average, Poor)	A	G	G	G	G	G	A	A	G	G	G	P	P	?	?
Training available (Good/ Poor)	G	G	G	G	G	G	P	P	G	G	G?	P	P	?	?
PRODUCTION & INCOME															
Main irrigated crop (summer)	Maize	Cotton	Sugarcane	Veg	Maize	Maize	Maize	Maize	Sugarcane ¹	Tomatoes	?	Maize	Maize	Maize	Maize
Main irrigated crop (winter)	Veg	Citrus	Sugarcane	Veg	Veg	Veg	Bears	Tom	Sugarcane ¹	?	?	Veg	Veg/wheat	Cabbage	Cabbage
Significant rainfed contribution	Y	N	Y	Y	N	N	N	?	Y	Y	Y	N	N	N	N
% Cropping intensity (summer)	84	89	100% ²	100%	100%	61%	100	90	50% ²	?	?	90%	70%	?	?
% Cropping intensity (winter)	27	33	100% ²	100%	?	20% ²	100	80	50% ²	?	?	?	?	?	?
Average income from irrigation (summer)	15,171	4,057	?	?	2,180	1,414	2,600	427	393	214	1,100	1,600	900E	1,200E	
Average income from irrigation (winter)	3,257	1,700	?	16,000E	3,532	900	2,557	1,814	512	579	206	460	1,500	1,000E	1,500E
Average income from rainfed production	?	?	?	13000E	0	0	?	?	1,100	2,357	586	0	0	?	?
Average income from other sources	1,429	286	5,125E	10,000E	4,750	6,170	?	1,586	467	1,047	950	2,000	880	1,100E	700E
MARKETING															
Do farmers sell to local markets?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Do farmers sell to distant markets?	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y
Active marketing groups for irrigation	Y	?	N	N	N	N	N	Y	N?	N	Y	N	N	Y	Y
Proportion of maize crops sold (RF = Rainfed, GM=Green Mealie)	50%	44%	20%(RF)	?	50%	20%	34%	62%	70%(GM)	>70%(GM)	?	1%	50%	80 (GM)%	60%
Proportion of vegetables sold	>80%	80%	60%	100%	60%	>60%	>80%	>80%	>60%	>60%	?	>60%	60%	90%	100%
Proportion of cash crops sold	65%	70%	100%	100%	NA	NA	>50%	50%	70%	NA	?	NA	100%	?	?
Current use of contracts & GAs (Minimal/Widespread/None)	M	W	M	W	M	M	M	W	N	N	N	N	M	M	M
Processing & packaging (Minimal/Widespread/Some/None)	S	S	M	N	S	S	N	N	M	M	M	S	S	N	M
Grading & cleaning (Minimal/Widespread/Some/None)	M	M	M	W	M	M	M	M	M	M	M	S	S	M	S
Advertising (Minimal/Widespread/ Some/ None)	N	N	N	N	S	S	N	S	M	M	M	N	N	N	N
CONSTRAINTS															
Transport (High/ Medium/ Low/ Nb)	H	H	M	N	M	M	H	H	H	H?	H	H	M	M	H
Water (High/ Medium/ Low/ Nb)	M	L	M	N	M	M	M	M	L	N	L	H	M	?	?
Market glut (High/ Medium/ Low/ Nb)	L	L	N	N	M	L	M	?	L	L	L	N	M	H	H
Lack of co-operation between farmers (High/ Medium/ Low)	L	L	?	N	L	M	?	?	L	L	L?	L	M	H	?
Credit (High/ Medium/ Low/ Nb)	L	L	L	N	L	M	L	L	L	H	H	M	L	M	?
Cost of inputs (High/ Medium/ Low/ Nb)	M	H	?	N	L	L	H	H	L	?	?	H	L	?	M
Availability of inputs (High/ Medium/ Low/ Nb)	L	L	N	N	L	L	M	H	L	L	L	H	L	?	?
Ploughing (High/Medium/Low/None)	M	?	?	N	H	?	?	?	NA	NA	NA	?	H	?	?
Key constraint (M=Market, T=Transport, W=Water, C=Credit)	T	?	?	Contract terms	M	M	?	?	M/T	C/T	C/T	W	M/T	M	M/T

Table 5 Schemes sorted by key constraint

	Water		Credit/ Marketing		Marketing						Contract terms	Unidentified			
	Apel (SA)	Tsviyo (ZIM)	Chendebevu (ZIM)	Wenimbi (ZIM)	Strydkraal (SA)	Gari (ZIM)	Ntamkuphi (SW)	Mbekelweni (SW)	Thabina (SA)	Dingleydale (SA)	Maplotini (SW)	Lilanda (SW)	Negomo (ZIM)	Deure (ZIM)	Tawona (ZIM)
BACKGROUND															
Local population density (High/med/low)	H	M	M	?	H	M	?	?	H	H	M	?	?	?	?
Roads and railways (Good/Poor)	P	P	P	G	G	P	?	?	G	G	G	P	G	G	P
Rainfall (mm/annum)	400	?	?	8-900	400	?	800?	80?	700	600	800?	800?	750-1000	4-500	4-500
Frost free (Yes/No)	N	?	?	N	N	N	?	?	Y	Y	?	?	?	Y	Y
Access to irrigated land (Yes/No/Some)	N	?	Y	Y	S	Y	?	?	N	Y	?	M	Y	N	Y
INFRASTRUCTURE															
Scheme size (ha)	22.8ha	?	?	36	338ha	?	?	?	220ha	1650ha	71 (veg)	42	360	302	165
Average plot size (ha)	0.08ha ²	?	?	1.6	1.2ha	?	0.4	0.4	2.2ha	3ha	N/A	1.5	1.2	0.8	0.8
Nb. of plot holders	300	56	168	22	256	87	?	?	143	1200	71	14	296	423	264
Water reliability (Good, Satisfactory, Poor)	P	G	G	G	S	G	?	?	S	S	G	G	G	S	P
Pumped/ Gravity	P	G	G	P	P	G	?	?	PG	G	P	P	P	G	P
Surface/ Sprinkler/ Drip/Buckets	S	B	B	Sp	S	B	?	?	S	S	D	Sp	Sp	S ⁴	S
Age of scheme (years)	9	10	3	10	50+	3	?	?	40	41	2	2	5	55	49
INSTITUTIONAL															
Management (Farmer/ Agency/ NGO/ Private)	F	FNCD	FNCD	F	FA	FNCD	?	?	FA	FA	P	F/P	A	A	A
Cost recovery (High/Low)	H	H	H	H	?	H	?	?	?	?	H	H	L	?	?
Commercial links (Good/Average/Poor)	P	?	?	P	P	?	?	?	A	A	G	G	G	P	P
Support services (Good, Average, Poor)	P	G	G	A	P	G	?	?	G	G	G	G	G	A	A
Training available (Good/ Poor)	P	G	G	G	P	G	?	?	G	G	G	G	G	P	P
PRODUCTION & INCOME															
Main irrigated crop (summer)	Maize	Tomatoes	?	Maize	Maize	Sugarcane ¹	Maize	Maize	Maize	Maize	Veg	Sugarcane	Cotton	Maize	Maize
Main irrigated crop (winter)	Veg	?	?	Veg	veg/whs	Sugarcane ¹	Cabbage	Cabbage	Veg	Veg	Veg	Sugarcane	Citrus	Beans	Tom
Significant rainfed contribution	N	Y	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	?
% Cropping intensity (summer)	90%	?	?	84	70%	50% ²	?	?	100%	61%	100%	100% ²	89	100	90
% Cropping intensity (winter)	?	?	?	27	?	50% ²	?	?	?	20% ²	100%	100% ²	33	100	80
Average income from irrigation (summer)	1100	393	214	15,171	1,600	427	1,200E	900E		2,180		?	4,057	1,414	2,600
Average income from irrigation (winter)	460	579	206	3,257	1,500	512	1,500E	1,000E	3,532	900	16,000E	?	1,700	2,557	1,814
Average income from rainfed production	0	2,357	586	?	0	1,100	?	?	0	0	13,000E	?	?	?	?
Average income from other sources	2,000	1,047	950	1,429	880	467	700E	1,100E	4,750	6,170	10,000E	5,125E	286	?	1,586
MARKETING															
Do farmers sell to local markets?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Do farmers sell to distant markets?	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Active marketing groups for irrigation	N	N	Y	Y	N	N ²	Y	Y	N	N	N	N	?	N	Y
Proportion of maize crops sold (RF = Rainfed, GV=Green/Mealie)	1%	>70%(GM)	?	50%	50%	70%(GM)	60%	80 (GM)%	50%	20%	?	20% (RF)	44%	34%	62%
Proportion of vegetables sold	>60%	>60%	?	>80%	60%	>60%	100%	90%	60%	>60%	100%	60%	80%	>80%	>80%
Proportion of cash crops sold	NA	NA	?	68%	100%	70%	?	?	NA	NA	100%	100%	70%	>50%	50%
Current use of contracts & GPs (Minimal/Widespread/None)	N	N	N	M	M	N	M	M	M	M	W	M	W	M	W
Processing & packaging (Minimal/Widespread/Some/None)	S	M	M	S	S	M	M	N	S	S	N	M	S	N	N
Grading & cleaning (Minimal/Widespread/Some/None)	S	M	M	M	S	M	S	M	M	M	W	M	M	M	M
Advertising (Minimal/Widespread/ Some/ None)	N	M	M	N	N	M	N	N	S	S	N	N	N	N	S
CONSTRAINTS															
Transport (High/ Medium/ Low/ No)	H	HP	H	H	M	H	H	M	M	M	N	M	H	H	H
Water (High/ Medium/ Low/ No)	H	N	L	M	M	L	?	?	M	M	N	M	L	M	M
Market glut (High/ Medium/ Low/ No)	N	L	L	L	M	L	H	H	M	L	N	N	L	M	?
Lack of co-operation between farmers (High/ Medium/ Low)	L	L	L ²	L	M	L	?	H	L	M	N	?	L	?	?
Credit (High/ Medium/ Low/ No)	M	H	H	L	L	L	?	M	L	M	N	L	L	L	L
Cost of inputs (High/ Medium/ Low/ No)	H	?	?	M	L	L	M	?	L	L	N	?	H	H	H
Availability of inputs (High/ Medium/ Low/ No)	H	L	L	L	L	L	?	?	L	L	N	N	L	M	H
Ploughing (High/Medium/Low/None)		NA	NA	M	H	NA	?	?	H		N		?	?	?
Key constraint (M=Market, T=Transport, W=Water, C=Credit)	W	CM	CM	M	M	M	M	M	M	M	Contract terms	?	?	?	?

Table 6 Schemes sorted by management type

	Farmer					Farmer/NGO					Farmer/Agency Farmer/Private				Agency			Private		(Ukrov)	
	Apel (SA)	Wenimbi (ZIM)	Tsviyu (ZIM)	Chendebevu (ZIM)	Gari (ZIM)	Thabina (SA)	Dingleydale (SA)	Strydakraal (SA)	Lilanda (SW)	Deure (ZIM)	Tawona (ZIM)	Negomo (ZIM)	Maplotini (SW)	Mbekelweni (SW)	Ntamkuphi (SW)						
BACKGROUND																					
Local population density (High/med/low)	H	?	M	M	M	H	H	H	?	?	?	?	M	?	?						
Roads and railways (Good/Poor)	P	G	P	P	P	G	G	G	P	G	P	G	G	?	?						
Rainfall (mm/annum)	400	8-900	?	?	?	70	60	40	80?	450	450	70-100	80?	80?	80?						
Frost free (Yes / No)	N	N	?	?	N	Y	Y	N	?	Y	Y	?	?	?	?						
Access to rainfed land (Yes/No/Some)	N	Y	?	Y	Y	N	Y	S	M	N	Y	Y	?	?	?						
INFRASTRUCTURE																					
Scheme size (ha)	22.8ha	36	?	?	?	21ha	168ha	338ha	42	312	165	30	7(veg)	?	?						
Average plot size (ha)	0.08 ²	1.6	?	?	?	22	3	12	15	08	08	12	NA	04	04						
No. of plot holders	300	22	56	168	87	143	120	286	14	423	264	26	71	?	?						
Water reliability (Good, Satisfactory, Poor)	P	G ³	G	G	G	S	S	S	G	S	P	G	G	?	?						
Pumped / Gravity	P	P	G	G	G	PG	G	P	P	G	P	P	P	?	?						
Surface / Sprinkler / Drip/Buckets	S	Sp	B	B	B	S	S	S	Sp	S	S	Sp	D	?	?						
Age of scheme (years)	9	10	10	3	3	40	41	50+	2	55	49	5	2	?	?						
INSTITUTIONAL																					
Management (Farmer / Agency / NGO / Private)	F	F	F/NGO	F/NGO	F/NGO	FA	FA	FA	BP	A	A	A	P	?	?						
Cost recovery (High / Low)	H	H	H	H	H	?	?	?	H	?	?	L	H	?	?						
Commercial links (Good/Average/Poor)	P	P	?	?	?	A	A	P	G	P	P	G	G	?	?						
Support services (Good, Average, Poor)	P	A	G	G	G	G	G	P	G	A	A	G	G	?	?						
Training available (Good / Poor)	P	G	G	G?	G	G	G	P	G	P	P	G	G	?	?						
PRODUCTION & INCOME																					
Main irrigated crop (summer)	Maize	Maize	Tomatoes	?	Sugarcane ¹	Mize	Mize	Mize	Signcare	Mize	Mize	Coton	Veg	Mize	Mize						
Main irrigated crop (winter)	Veg	Veg	?	?	Sugarcane ¹	Veg	Veg	Veg/vhrt	Signcare	Bans	Tom	Gins	Veg	Gihge	Gihge						
Significant rainfed contribution	N	Y	Y	Y	Y	N	N	N	Y	N	?	N	Y	N	N						
% Cropping intensity (summer)	90%	84	?	?	50%?	100%	60%	70%	100%?	100	90	89	100%	?	?						
% Cropping intensity (winter)		27	?	?	50%?	?	20%?	?	100%?	100	80	33	100%	?	?						
Average income from Irrigation (summer)	1,100	15,171	393	214	427	2180	1600	?	1,44	2600	4057	?	90E	120E							
Average income from Irrigation (winter)	460	3,257	579	206	512	3,532	900	1,500	?	2,557	1,814	1,700	16,000E	1,000E	1,500E						
Average income from rainfed production	0	?	2,357	586	1,100	0	0	0	?	?	?	?	13,000E	?	?						
Average income from other sources	2,000	1,429	1,047	950	467	4,780	6,170	880	5,128E	?	1,586	286	10,000E	1,100E	70E						
MARKETING																					
Do farmers sell to local markets?	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
Do farmers sell to distant markets?	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y						
Active marketing groups for irrigation	N	Y	N	Y	N?	N	N	N	N	N	Y	?	N	Y	Y						
Proportion of maize crops sold (RF = Rainfed, GM=Green Mealie)	1%	50%	>70%(GM)	?	70%(GM)	50%	20%	50%	20%(RF)	34%	62%	44%	?	80(GM)?	60%						
Proportion of vegetables sold	>60%	>80%	>60%	?	>60%	60%	>60%	60%	60%	>80%	>80%	80%	100%	90%	100%						
Proportion of cash crops sold	NA	65%	NA	?	70%	NA	NA	100%	100%	>80%	50%	70%	100%	?	?						
Current use of contracts & GAs (Minimal/Widespread/None)	N	M	N	N	N	M	M	M	M	M	W	W	W	M	M						
Processing & packaging (Minimal/Widespread/Some/None)	S	S	M	M	M	S	S	S	M	N	N	S	N	N	M						
Grading & cleaning (Minimal/Widespread/Some/None)	S	M	M	M	M	M	M	S	M	M	M	M	W	M	S						
Advertising (Minimal/Widespread/ Some / None)	N	N	M	M	M	S	S	N	N	N	S	N	N	N	N						
CONSTRAINTS																					
Transport (High / Medium / Low / No)	H	H	H?	H	H	M	M	M	M	H	H	H	N	M	H						
Water (High / Medium / Low / No)	H	M	N	L	L	M	M	M	M	M	M	L	N	?	?						
Market glut (High / Medium / Low / No)	N	L	L	L	L	M	L	M	N	M	?	L	N	H	H						
Lack of co-operation between farmers (High / Medium / Low)	L	L	L	L?	L	L	M	M	?	?	?	L	N	H	?						
Credit (High / Medium / Low / No)	M	L	H	H	L	L	M	L	L	L	L	L	N	M	?						
Cost of inputs (High / Medium / Low / No)	H	M	?	?	L	L	L	L	?	H	H	H	N	?	M						
Availability of inputs (High / Medium / Low / No)	H	L	L	L	L	L	L	L	N	M	H	L	N	?	?						
Ploughing (High/Medium/Low/None)		M	N/A	N/A	NA	H	H		?	?	?	N	N	?	?						
Key constraint (M= Market, T=Transport, W=Water, C=Credit)	W	T	C/T	C/T	M/T	M	M	MT	?	?	?	?	Contract terms	M	MT						

3.2.1 Table 2– Country

15 schemes sorted by country: South Africa (Thabina, Dingleydale, Apel and Strydkraal), Zimbabwe (Deure, Tawona, Wenimbi, Negomo, Gari, Tsviyo and Chendebvu) and Swaziland (Mbekelweni, Ntamkuphi, Lilanda and Maplotini). The main points which can be seen are that:

- Annual rainfall varies between and also within countries. Two of the SA schemes (Apel and Strydkraal) have a low annual rainfall (400mm), and none of the SA schemes have an average rainfall greater than 700mm. The schemes in Swaziland all receive an average of 800mm, whereas in Zimbabwe where there is a greater number of study schemes covering a wider area, average rainfall is more variable, with a range of 400–1000mm.
- Where data are available, water delivery appears to be more reliable in the Zimbabwean schemes than in the South African study schemes.
- There is no significant rain-fed contribution in the South African schemes, whereas several of the schemes in Zimbabwe and Swaziland have access to rainfed plots, which contributes to farmers' annual income and food security.
- In the four South African schemes, no marketing groups were reported for irrigation, whereas such groups do exist on some schemes in Zimbabwe and Swaziland.

3.2.2 Table 3 – Plot size

15 schemes sorted by average irrigated plot size (using data from the survey). Three categories were used: average plot size less than 0.5ha (Apel, Gari, Tsviyo, Chendebvu, Mbekelweni, and Ntamkuphi), average plot size between 0.5 and 1.5ha (Deure, Tawona, Negomo, Strydkraal) and average plot size greater than 1.5ha (Thabina, Dingleydale, Wenimbi, Lilanda and Maplotini). The main points that can be seen are that:

- There appears to be a relationship between plot size and road access, whereby the schemes with small plots (<0.5ha) tend to have poor access to roads. This may arise from the fact that farmers with small plots tend to be mainly subsistence farmers, often based on schemes or small gardens developed by NGOs with the main aim of increasing food security in remote areas. Transport in these schemes may not be seen as a high constraint until farmers begin producing a surplus for marketing.
- Transport is not seen as a high constraint for most schemes with an average plot size greater than 1.5ha. This may be because farmers with more land (and therefore able to produce more) could have more 'pulling power' with which to encourage buyers to collect from the scheme. Alternatively, they could have more money with which to pay for transport. Large schemes also tend to have better road access than the smaller schemes with small average plot size.

3.2.3 Table 4 – Commercial activity

15 schemes sorted by commercialisation categories: highly commercial (Wenimbi, Negomo, Lilanda, Maplotini), moderately commercial (Thabina, Dingleydale and Deure) and minimally commercial (Tawona, Gari, Tsviyo, Chendebvu, Apel and Strydkraal). For Mbekelweni and Ntamkuphi insufficient information meant that they couldn't be included in the classification. From Table 4 it can be seen that most of the highly commercial schemes:

- have similar size plots (1.2 – 1.6ha);
- have good water reliability;
- have good access to roads and transport is not a high constraint;
- are all pumped, with water delivery by sprinkler or drip;
- have all been developed in the last 10 years (probably with farmer input & participation);
- have good cost recovery;
- have good support services and training available;
- don't appear to have problems with market glut, credit, obtaining inputs or lack of co-operation amongst farmers;
- are in Zimbabwe and Swaziland.

The moderately commercialised schemes:

- all have good road access;
- are all large schemes (220 – 1650ha) with large numbers of plot holders;
- are all over 40 years old.

The schemes with minimal commercialisation:

- all have poor road access and see transport as a high constraint;
- vary in time established between 3 and 50 years;
- have small plot sizes (less than 0.08 ha) with the exception of Tawona and Strydkraal;
- are mainly farmer managed (with assistance from NGOs/Agency).

Many of the younger schemes have been developed with commercial activity in mind (e.g. Wenimbi and Negomo), and are now seen as highly commercial. The older schemes which were developed for subsistence purposes initially (e.g. Thabina and Dingleydale) are now undertaking some commercial activity and take advantage of their good road access. On the other hand, the small garden schemes (e.g. , Gari, Tsviyo and Chendebvu and Apel), also developed initially to increase food security and eradicate poverty, are now undertaking some commercial activity but tend to suffer from poor road access.

The fact that none of the South African schemes fall into the category of highly commercial, could possibly be explained by the fact that all these schemes are reliant on irrigated agriculture with no significant contribution from rainfed agriculture (in terms of both food and income). This may result in household food requirements having to be met from irrigated produce, before any marketing of surplus produce can take place.

Although the survey has shown that pumped schemes can be commercially successful and meet the needs and costs of maintenance, pumping alone is no guarantee of success. However, it is apparent, that if a scheme is commercially successful it is more likely to be able to sustain the operation & maintenance costs associated with pumping.

3.2.4 Table 5 – Key constraint

The 15 schemes were divided into categories according to the research team’s subjective assessment of the main constraints identified in the survey. Marketing and transport constraints reported by farmer respondents were merged together into the category “marketing” on the basis that where transport was highlighted as a constraint it was generally linked with market access. The main points apparent in Table 5 are that:

- Marketing is seen to be the key constraint in many of the schemes across all countries, plot sizes and levels of commercialisation.
- Although other constraints such as water and access to credit do exist they are only occasionally regarded as the key constraint.

3.2.5 Table 6 – Scheme Management

In Table 6, the 15 schemes were divided into four groups, namely: farmer managed (Apel and Wenimbi), farmer managed with assistance from NGOs (Gari, Tsviyo, Chendebvu) farmer managed with assistance from agencies or private companies (Thabina, Dingleydale, Strydkraal and Lilanda), management undertaken by agency or private company (Deure, Tawona, Negomo and Maplotini). The Management arrangements for Mbekelweni and Ntamkuphi were again unknown due to a lack of information. The main points from Table 6 are that:

- The NGO assisted schemes tend to have poor road access
- The schemes assisted and managed by agencies or private companies are mostly situated with good road access
- Cost recovery appears to be high on the farmer managed and NGO assisted schemes
- Lack of co-operation between farmers is not a constraint on farmer managed and NGO assisted schemes

Similar explanations as to those given for the plot size table can be used to explain these issues. For example, the NGO assisted schemes have often been developed for poverty eradication and food security purposes in rural areas where roads are poor, but because of the small size, farmers will probably be more co-operative.

3.2.6 Trends in numeric data

Some of the numeric data from the summary tables were presented in graphical form and used to prompt discussion. That data and the discussion that followed are set out here. It should be noted that some data sets are poor or incomplete and the picture presented is only a first indication of scheme performance at any of the sites. The discussion illustrates what might be learned by looking at data.

a) Record keeping by farmers

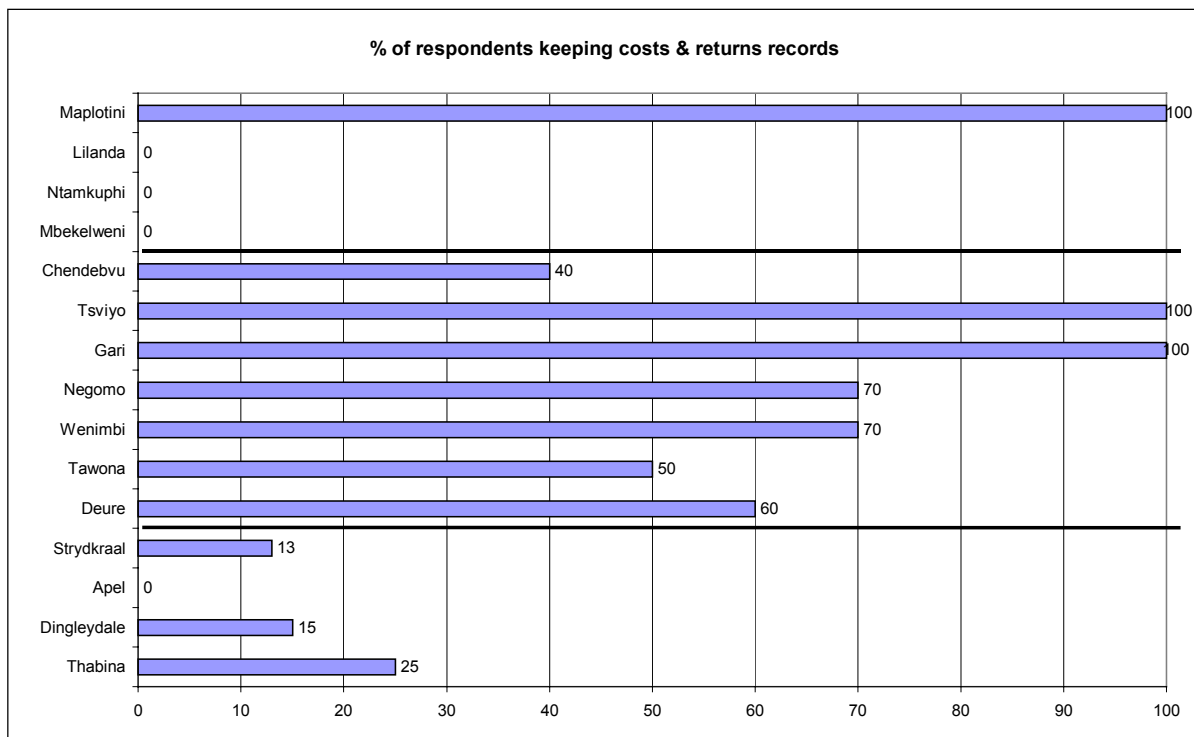


Figure 1 Percentage of respondents keeping records of costs and returns

Figure 1 shows a generally a higher level of record keeping amongst farmers in Zimbabwe than in South Africa or Swaziland. It is also true that levels of record keeping are higher in those schemes considered to be more highly commercially orientated. However, the keeping of records does not automatically indicate strong commercial orientation. Tsviyo and Gari are both small, communal garden schemes in Zimbabwe with the primary objective of improved household nutrition. Only small quantities of produce are sold, mainly into the local market. Their very high level of record keeping – apparently 100% – is a consequence of the training and support given by the NGO CARE. It is not clear whether the farmers on these schemes used their records in plot management and decision making. The general trend towards higher levels of record keeping in Zimbabwe was attributed to training and encouragement given over a long period by the extension service, AGRITEX.

b) Average household incomes

Figure 2 shows *average* declared incomes from irrigated summer and winter cropping, rainfed cropping and other, non-farm, activities. Data from Zimbabwe were converted to Rand at an exchange rate of 7 Zim\$ to the Rand.

The accuracy of the data did not justify conversion to a unit area basis as data on plot sizes were not always available. Despite this limitation, and the concern that averages conceal wide variations between individuals on a scheme, Figure 2 raises the following valuable points:

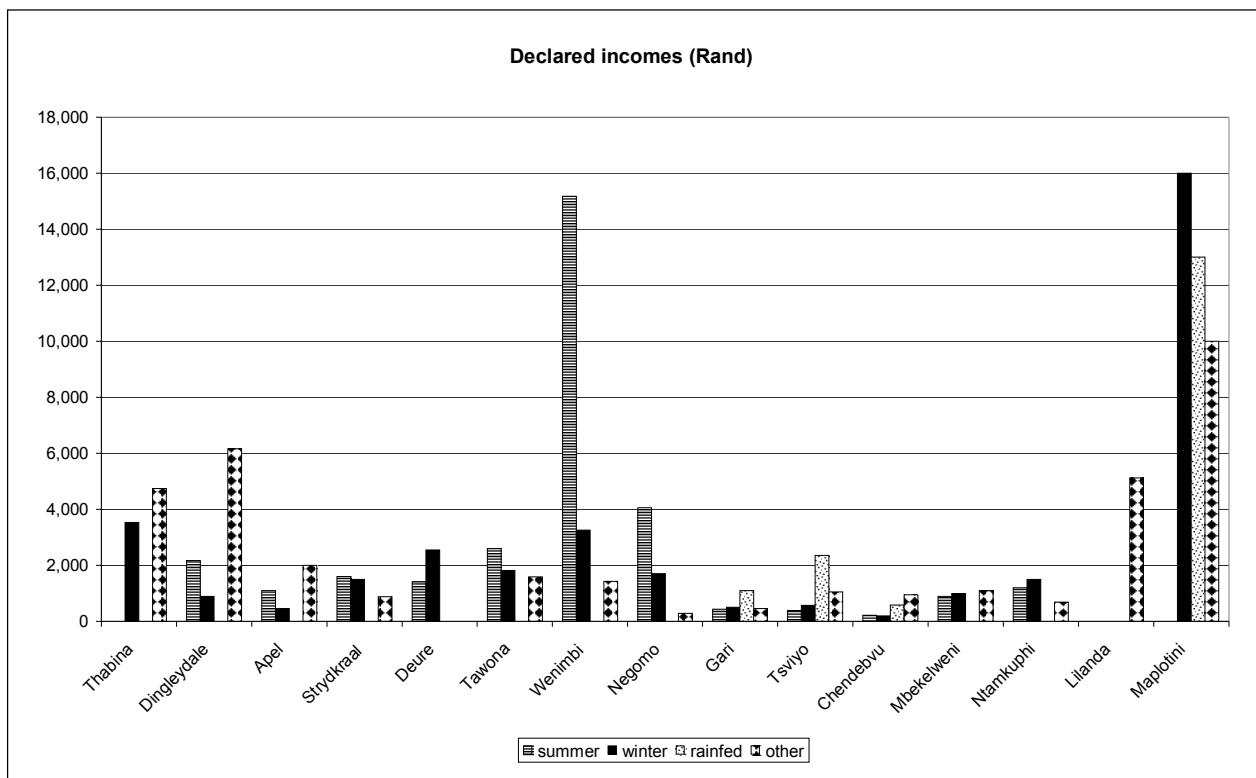


Figure 2 Average household incomes amongst respondents

i) Non-agricultural income

In South Africa, Thabina and Dingleydale, report higher average incomes from non-farming activities than from irrigated production. This is mainly a consequence of respondents receiving state pensions.

ii) High irrigated income

Wenimbi and Maplotini stand out as two schemes with much higher incomes from irrigated production than any of the other 13. Wenimbi sees greatest income in the summer, Maplotini in the winter. If income is seen as an indicator of commercialisation or commercial “success” then these schemes merit further review to identify the causes of such performance.

The “success” of Maplotini depends entirely on the capital backing of an external entrepreneur funding the provision of irrigation infrastructure, management expertise, transport to market and produce marketing. Discussion revealed that since the survey was carried out the entrepreneur had withdrawn his support and the scheme is now abandoned.

The “success” of Wenimbi appears to be more sustainable. It is a small scheme with only 22 households. It was built recently with the effective participation of the end users throughout the design and construction phases and the farmers appear to have taken the active decision to give greater attention to the growing of high value, commercial vegetable crops as Figure 3 illustrates.

c) Summer and winter irrigated cropping

Figures 3 and 4 show the average allocation of irrigated land to grain maize, vegetable crops and cash crops in winter and summer seasons reported for 4 schemes in Zimbabwe. Cash crops include wheat, cotton, groundnuts and beans. In the summer season (Figure 3) average cropping intensity ranges from 99% (Deure) to 78% (Negomo). Tawona and Deure represent “traditional” schemes where more than 70% of summer irrigation is devoted to grain maize. By contrast, Wenimbi farmers use only about 30% of their plot for grain maize and give 50% of their land over to vegetables. Negomo farmers, like those at Wenimbi, give only a small percentage of their land to grain maize but despite their focus on vegetables and cash crops their summer irrigated cash income is little more than a quarter that seen in Wenimbi.

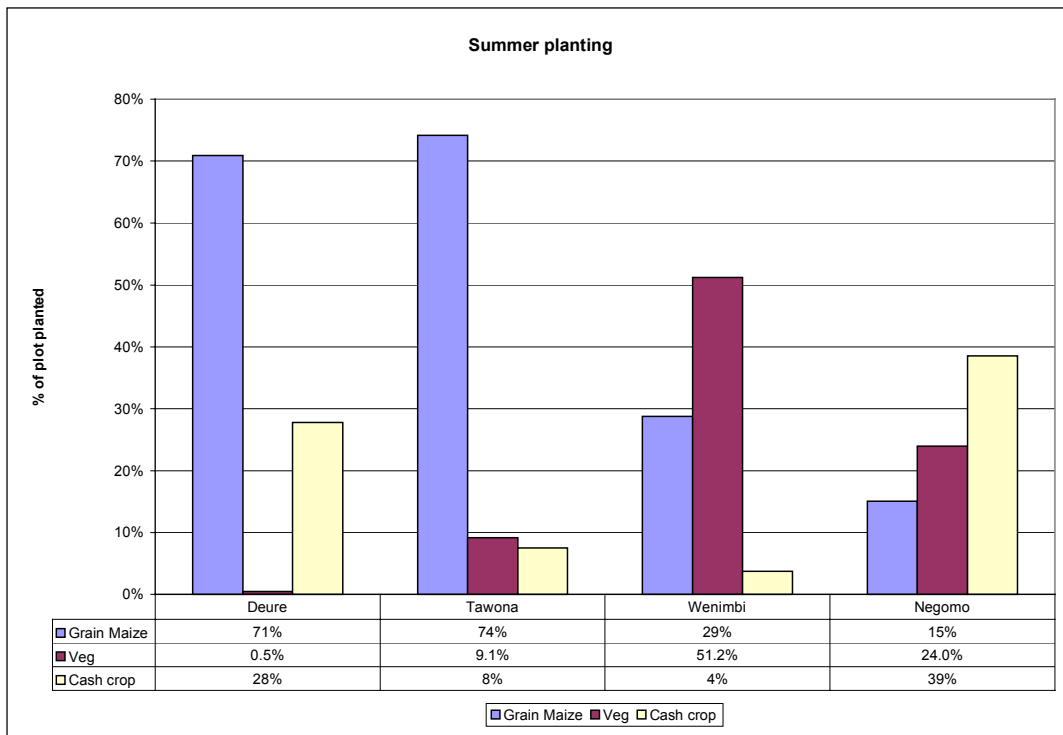


Figure 3 Average summer cropping patterns on 4 Zimbabwe schemes

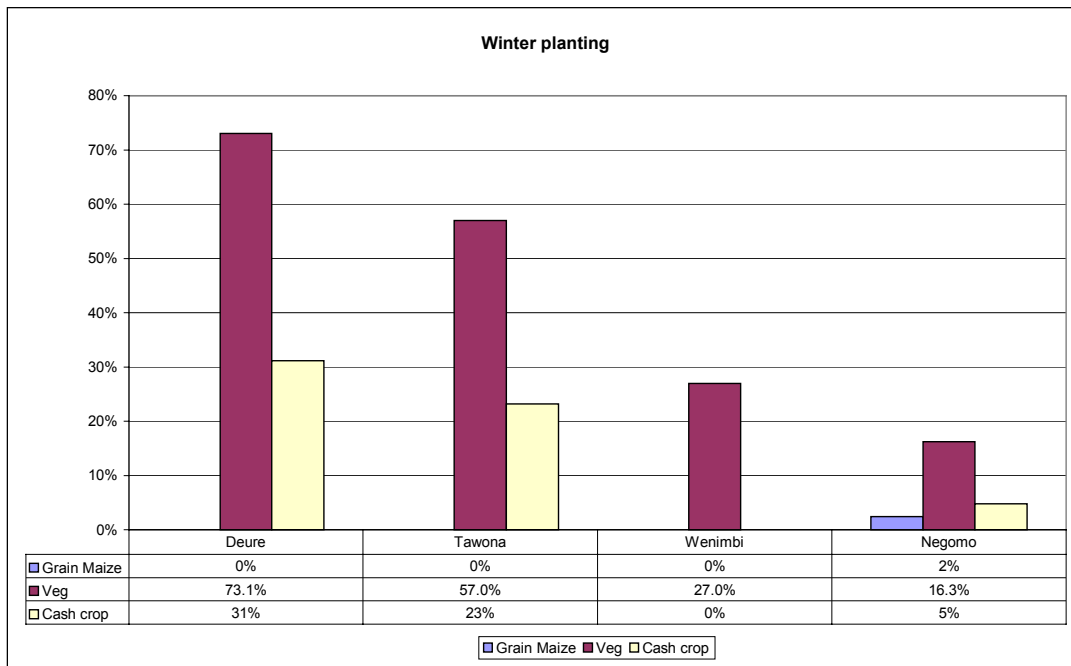


Figure 4 Average winter cropping patterns on 4 Zimbabwe schemes

In the winter season, farmers in all 4 schemes give the greatest part of their plots to vegetables. In Deure and Tawona cropping intensities lie at 100% and 80% respectively but in Wenimbi and Negomo, where winter temperatures are lower and there is a risk of frost, land use is much less intensive in the winter.

d) Discussion

It was questioned whether the high income recorded for Wenimbi was a consequence of their reliance on a pumped supply – are they compelled to make high incomes in order to pay the pump costs? This seemed unlikely as there are several other schemes also facing high costs for the operation of pumps but their incomes are not similar.

It was pointed out that both Wenimbi and Negomo have some of the largest average plot sizes of the schemes studied. Thus farmers could “afford” to allocate a smaller fraction of their plot to grain maize but still secure an adequate supply for their household. It was also pointed out that due to the high summertime temperatures at Deure and Tawona, farmers there might encounter problems not experienced at Wenimbi and Negomo if they sought to grow many types of vegetables. Such problems would be associated with peak daytime temperatures as well as a possible increased incidence of disease.

3.3 Overall Impressions

The overall picture as illustrated by the five tables and numeric data is very complex. The tables, graphs and accompanying notes simply illustrate the potential for monitoring how schemes perform through assembling information and identifying patterns. It is not possible to claim any clear correlation between one factor and commercial success. However, it is clear that all schemes are to some extent dependant on Government, Donor or NGO assistance.

In conclusion, a summary of the researchers’ ‘impressions’ was presented. They were identified as impressions, because, although they draw on the survey and interview data, it is recognised that these data are imperfect. It is important to note that no ‘impressions’ apply to all schemes all of the time.

1. Generally, results and benefits on smallholder irrigation schemes are less than anticipated. The availability and control of the primary resource, water, has not resulted in widespread increases in secure, sustainable production and reliable incomes capable of covering the capital and the operational

and maintenance costs of irrigation infrastructure. There are, however, examples of commercial success both at scheme level and at individual farm level for some schemes. These examples tend to be in newer, younger, schemes that have been designed to provide for commercial production and in which the farmer stakeholders have been involved from the beginning in assessment of viability, scheme design and management.

2. Most smallholder irrigators produce one or more subsistence crops from their irrigated land. This traditional approach to farming provides for food security but does not directly generate cash income to pay for the costs of irrigated production. Scheme design and management (and support agencies) needs to account for farmer objectives and resource relationships between subsistence and cash incomes, when seeking a framework to promote business orientated, commercial farming.
3. There are poor links to the commercial market at all levels - wholesale, retail, or directly with consumers. Links and interactions with the market place tend to be ad hoc and based on chance rather than organised interventions. Most farmers market as individuals in both transporting and selling products. There is little evidence of collective activity in negotiating with transport owners and buyers to achieve economies of scale or to achieve greater influence in the market place. A few farmers, as individuals, have contracts with buyers but many of these report negative experiences associated with reliability and worth of the contracts. These experiences may result from poor knowledge and skills on the part of the farmers and/or from weak systems and structures for enforcing contractual agreements.
4. In some schemes, members have been involved from the beginning in scheme design and identification and operation of irrigation technologies. In many others members cope with 'inherited' irrigation technology and scheme design. Farmer involvement tends to be greater in newer schemes and, there is some evidence above, that these are more successful. The previous experience of schemes in an 'inherited' situation was to be subject to, and separate from, some form of central management control. Only relatively recently have the scheme members become involved in making decisions on managing the schemes. These farmers are now confronting new experiences and new risks as they begin to create structures to take over responsibility for management and for securing the financial viability of schemes that provide the main resource of their livelihoods, but for which they may have little sense of 'ownership'.

On many schemes there appear to be poor frameworks for scheme level decision making, a poor sense of identity or ownership of the scheme, resulting in unclear objectives. This impression is largely based on observation of schemes in South Africa. Without overall objectives or goals that represent the present needs and future aspirations of members for the scheme there is no central reference point for strategic planning. This is not to suggest that irrigation schemes by definition should be run and managed as completely collective enterprises in terms of production and marketing. However, all schemes need objectives and strategies that provide a framework for managing the shared water and land resource, even if these aim to provide opportunities for maximising individual members' production and marketing choices.

4. SCHEME OBJECTIVES – WORKING GROUPS AND SUMMARY

4.1 Discussion paper: Scheme objectives and how they are agreed

Without an objective it is very difficult to prioritise actions. The aim of this paper is to look at the objectives of irrigation scheme members and their committees and promote discussion of who should be involved in adopting objectives and how they should be arrived at.

The majority of farmers on most of the schemes has limited resources and generate low incomes from irrigation. Relatively remote locations mainly on areas of low potential, along with weak consumer demand, further exacerbate low-income generation. Typically these areas lack infrastructure and are poorly served with transport, making transaction costs high and distant marketing arrangements unreliable.

Several of the problems faced in these circumstances are beyond farmer control; others might be alleviated by collective or communal action. In order to determine what form communal action might take, people have to **reach a consensus about what they want to get out of the irrigation scheme**. In turn that leads to questions about how you find a collective objective or a range of objectives that meets the needs of the members.

It seldom is obvious that common objectives are consistently pursued. In reviewing the schemes in this study it is not clear how many farmer committees formally, or even informally, adopted targets, nor if such an approach was considered and rejected.

Neither is it clear if the business objectives of the membership are clearly reflected in management decisions relating to operation and maintenance. Management appears to be reactive dealing with crises as they arise and serving generalised objectives rather than specific targets set in a time frame.

Should we consider the impact of adoption of specific, widely agreed, objectives? It seems likely that a number of objectives might be required simultaneously at several different levels.

Features common to schemes in all three countries are:

- lack of individual titled land ownership
- sharing of a common water source
- common commitment to primary infrastructure
- low levels of asset accumulation
- labour intensive methods
- high involvement of women in production
- lack of commercial links and credit
- negative marketing experiences

For example:

Many interviews in the study touched on growing vegetables under contract. ***This is some evidence of wide agreement by farmers that contracts offer lucrative opportunity. However, this consensus may not be formally adopted as a scheme objective.*** Obtaining and fulfilling contracts is fraught with difficulties one of which is reliable water delivery to allow contract quantities to be fulfilled. If it is not possible to provide all members with the required water, an alternative second-level objective might be ***to ensure a minimum level of delivery to a specific area for a given period.*** If this objective is achieved only by disadvantaging some members, a third-level objective might be agreed, ***to devise a satisfactory compensation for those members, thereby spreading the benefit gained from the contract.***

Such arrangements have potential to motivate members to co-operate in an achievable management policy and provide everyone with an interest in the contract growers success.

On the other hand, irrigators may prefer strategies that allow them to continue to conduct business as separate individuals without reference to the activities of other members. In this case the objectives would be different and might include equity of water supply over the whole-irrigated area. Yet other circumstances might respond to objectives relating to credit, input acquisition, transport or marketing strategies. The core issues are:

- Inclusive participation;
- Setting clear achievable objectives;
- A high degree of trust and transparency;
- Close co-operation among farmers;
- Clear understanding between farmers and other stakeholders;
- Sympathetic institutional arrangements;
- Well-targeted and delivered support.

Participation is not an easy option. Training for participation is an essential part of a supportive policy. What sort of hierarchy and participation is needed to achieve agreements such as those discussed above?

Our observation is that participation in groups and membership of committees tends to be undertaken by farmers who are economically successful and achieve well above the average. There are many good reasons for these people being selected as representatives, yet at the same time, the proportion of so called 'successful' farmers tends to be small, maybe 20 % of scheme members. It seems that there is a correlation between success and group activity, however, what exactly does that mean:

- Do successful farmers become committee or group members? Or is the situation vice versa and membership of a group or committee leads to success?

At present we do not know which comes first or what the success of individuals who have been selected as representatives means for success of the scheme as a whole. Whatever comes out of discussing these relationships, the other side of the coin remains: ***the majority of members of irrigation schemes have low levels of participation.*** This may have implications for how a scheme is managed. For example, women are consistently under-represented on committees and schemes often operate in ways that disadvantage women farmers, such as requiring mechanisation for land preparation. Could the remaining 80 % of members be motivated and mobilised to contribute?

The majority of farmers act individually in running their farm businesses despite the necessity to share common resources such as water and infrastructure and despite the high individual costs of organising inputs or services or of transporting products. This may be fine in locations where demand is high and supply is a straightforward affair. However, in less favourable market conditions alternative strategies might be needed.

The general question is posed: *'Why is it the case that participation and therefore group action are not more popular?'* To tease out an understanding, answers to these questions might help:

- Is there a history of unsuccessful participation or past disappointment?
- Are there barriers to participation, like inconvenient times, places of meetings?
- Are people convinced by the concept of successful group action?
- What's the local evidence 'in favour' or 'against' organising in groups?
- Does the way the scheme works encourage or discourage co-operation?
- Is the mechanism for linking participation to institutional change effective?
- Are institutions convinced of the effectiveness of participation?

Although participation is promoted as an essential component of successful development, it is notoriously difficult to achieve in many sectors. Barriers to effective participation arise both among professional people and among the general population of grassroots individuals. This is nothing to do with the skills and educational level achieved by the individual, as after all, a professional in one sector may be a grassroots individual in another. For example, a professional irrigation engineer is likely to be a grassroots person in the health sector. Irrigation and agricultural professionals may feel threatened by participation, especially if it means change for them as individuals and farmers too may feel criticised or burdened by

participatory procedures. Another major factor is that institutions that were set up in the past, in a different political climate, may have procedures and arrangements that in themselves make participation difficult to handle, despite the best intentions of all stakeholders.

It is generally recognised that people need to see benefits in order to be persuaded that it is worth spending time and effort on participation. People need to feel comfortable about participating, not threatened or judged. When seeking to understand participation in irrigation schemes, or lack of it as the case may be, it is worth taking a look at what local people do engage in. Is there an example of successful participation in a non-irrigation activity in this area, and can the key features be identified and learnt from?

Posing the above questions can teach us much towards identifying and addressing barriers to participation. Below are some suggestions from earlier research concerning promotion of participation and evaluation of institutions which might also be helpful:

- Participation
 - Recognise that mass meetings have a role but cannot be relied upon to differentiate the valid needs of the different subgroups, particularly women.
 - Use existing groups and meeting points effectively to ensure that both men and women understand constraints and opportunities to successful irrigated farm businesses and can give their views in a comfortable unrestricted environment.
 - Investigate how information on participation techniques can be found.
 - Use participation to link the problems people experience in operating and maintaining their irrigation infrastructure and equipment to the different tasks that men and women are obliged to do and the different crops that they grow.
 - Recognise that explicit attention to women's needs and the needs of poorer and less able farmers can benefit all users.
 - Appreciate that the different objectives and resources available to men and women suggest that provision of a range of business options should be encouraged.
 - Encourage subgroups of stakeholders to reach consensus on at least some of their objectives.
 - Recognise that most communities focus on immediate problems and need help to identify long and medium term priorities.

- Institutions and management
 - Participation needs explicit attention and resources and must be budgeted for.
 - Structure participation by using checklists to so that agency and farmers use the process effectively to systematically include the needs of women and poor farmers.
 - Be aware of the differences between types of management and the consequences for men and women smallholders.
 - The trade-offs between freedom and responsibility should be carefully considered.
 - Arrange institutional inputs to be in the interest of both men and women, rich or poor smallholders i.e. avoid dealing only with a subgroup of members.
 - Ensure that stakeholders, such as service providers, who influence the performance of schemes, also benefit from the success of the scheme and underwrite its failure.
 - Appreciate that external linkages are crucial. For example high technology choices attract high repair costs unless links are established to ensure prompt, affordable, locally available services.

4.2 Group responses to questions

Questions:

- **Have efforts been made to identify overall scheme objectives or to find out what members want from the scheme?**
 - What are they?
 - How do people feel about these? (i.e. different people)
 - What affect have they had?
- **Do scheme members work together in other aspects or activities on the scheme?**
- **Do scheme members belong to groups or associations outside the scheme? What are their experiences of these?**
- **Are there examples of problems, or issues faced because there are no scheme objectives, or because objectives are unclear/ambiguous?**

In responding to the first question ‘Have efforts been made to identify overall scheme objectives or to find out what members want from the scheme? What are they and how do people feel about these and what effect have they had?’ it was clear that newer schemes had greater opportunity to identify objectives than older schemes.

Objectives were particularly clear for Swazi cane-growers but less so for vegetable growers. Examples quoted suggest a limited view of objective setting, often confined to crop choice. Group objectives largely depend on extension advice. Individual objectives are generally not differentiated into those of the individual family members, but the term was used to represent ‘farmer’ objectives. None of the working-groups described a process of objective setting but nonetheless recognised the importance of the individual objective of food security and income generation.

Groups gave examples of objectives at different levels:

Mission statements	such as poverty alleviation and scheme development
Goals	such as facilitating marketing and leadership development
Group objectives	such as introducing new cash crops or processing produce.
Targets	Only one group mentioned a target (a target would normally detail a task, a date or a cost budget) of completing rehabilitation, but gave no set date or details.

There was little appreciation of hierarchy in relation to objectives and participants were not clear as to how objectives might be used other than as an integral part of a constitution. Consequently little was reported on the effect that objectives had on the schemes. There was a general recognition that group decisions could be difficult and had potential to be unsatisfactory for the majority of the group. Lack of scheme objectives, however, was held by some to be responsible for a lot of time spent on conflict resolution, falling levels of production, lack of farmer commitment and even abandonment of plots. Although, discussion was unclear due to the lack of consensus on the nature of mission statements, goals and objectives there was little evidence of real understanding about how objectives could be used to guide decision-making or monitor progress.

On the other hand, it was clear that group activity was very much part of life. Working-groups found many examples of groups that appeared to work rather better than irrigation schemes, such as burial

groups, savings groups and poultry projects. Nonetheless, group activity does take place on irrigation schemes in relation to tasks such as acquiring inputs and addressing maintenance, and even in one place hiring a truck to take produce to market. Lack of trust was identified as a serious constraint to further development of group activity of this sort in relation to marketing.

In summing up the views of the working groups it seems that clearly stated objectives are not universal and this may be deemed to be an unsatisfactory situation. On the other hand Swazi “schemes” often enshrine their objectives in a written constitution which all scheme members must accept. An example is that of all members working together on certain tasks – the constitution states that any member failing to attend will be fined 5Rand /day. The Swazi participants emphasised the setting out of objectives in group or scheme constitutions.

CARE schemes use a memorandum of understanding between themselves and the community, which sets out the objectives of both CARE and community members. However, it was pointed out that on large systems such as Dingleydale, where several whole communities are involved, then scheme objectives which must take account of the wider picture, become more difficult to achieve.

4.3 Plenary discussion of group findings

The plenary session focussed substantially on the need for farmers and agencies to emphasise commercial viability and to assess scheme potential and economic strategies before deciding objectives.

- Although there were clearly country differences in the way that schemes behaved as groups, there were also significant differences between older and younger schemes.
- Schemes developed in a different political climate for central or top-down management had more difficulty with objectives than newer schemes where farmer autonomy was the order of the day.
- Large size was also considered to limit capacity for group action and many schemes where group objectives were established were small.
- The development of small groups to follow objectives within the larger scheme objective was briefly explored as a strategy to overcome the difficulty of achieving agreement between large numbers of farmers.

5. SCHEME DECISION-MAKING – WORKING GROUPS AND SUMMARY

5.1 Discussion paper: Decision-making/policy options

- Farmers, like everyone else, have to make decisions all the time. These include “What to do?” “When to do it?” and “How to do it?”. The aim of this discussion paper is to promote discussion of how decisions are made and how this influences farmers’ ability to develop sustainable businesses.
- Good decision-making involves:
 - (1) Defining the aim or objective; (What do you want to achieve?)
 - (2) Identifying the alternatives; (What are the different ways of achieving the objective?)
 - (3) Recognising the constraints preventing achievement of aims; (What might go wrong?)
 - (4) Making a choice, bearing these in mind; (Which alternative comes nearest to meeting your objective given the constraints?).
- The main objective of most farmers is to make money or profit. However, avoiding risk may also be important. Growing sufficient staple food to meet family needs is also often quoted as a key objective.
- Some decisions are important and have a big impact on future life-for example whether to join an irrigation scheme. Other decisions are much less important-such as whether to weed a crop today or tomorrow.
- Some decisions can be made individually- example, what crops to grow on a private vegetable plot.
- Other decisions are made by bargaining between two persons- example, what price will be paid for a bag of mealies.
- Yet other decisions must be made communally (or by a representative of the community such as the chief) – example the allocation of land, and irrigation water, between members of the community.
- The way decisions are made depends on whether these are individual or communal decisions. Individuals may or may not consult with others before making a decision. However, communal decisions must be made by direct or indirect involvement of community members. Before this involvement, decisions must be made on the best way for the community to share in decision making.
- Although, in some ways, individual decision-making is easier, since no-one else is involved, there may be advantages in communal decision-making. For instance if agreement can be reached on all growing the same crop and marketing the crop as a group, there may be savings in transport costs and scope for negotiating a better price.

Areas of decision-making that affect what farmers produce and sell

The following is a list of areas of decision-making that affect what farmers produce and sell. It is useful to study the list and think about these questions.

- (a) Which are the key areas offering most scope for improvement in decision-making involving the majority of scheme farmers?
- (b) What are the main problems faced in these key areas?
- (c) How are decisions currently made in these areas?
- (d) How might the problems be overcome?
- (e) What decisions could or should be made communally? What are the advantages and disadvantages of doing this? In what ways could collective decision making be organised?

1. ACCESS TO NATURAL RESOURCES

- (a) Land tenure and control
- (b) Allocation of water or water rights

These decisions are usually made by a local authority or the scheme management and may be subject to laws on land tenure and water rights. However, it is worth considering whether greater farmer participation in these decisions would be beneficial.

2. INFRASTRUCTURE

- (a) Location
- (b) Communications

There may be little the individual farmer can do to change these resources, location being linked with access to land. Communications may be improved through group activity to improve rural roads or to press local governments for help.

3. CAPITAL ASSETS

- (a) Buildings
- (b) Tractors and other machinery
- (c) Irrigation and other equipment
- (d) Technical knowledge

Availability of these assets varies from one scheme to another. In some cases machinery and equipment are available but in poor condition. Decisions are needed on what to do with worn and broken down machinery. Technical knowledge may be provided by the extension officers attached to many schemes. However, machinery, equipment, and technical knowledge need regular up-dating as technologies change. Decisions are needed on funding and acquiring machinery and equipment, and further training for extension workers and other scheme personnel.

4. MARKETS AND MARKETING

- (a) Production for sale versus home consumption
- (b) Where to sell; market places
- (c) Choice of methods of transport
- (d) Timing when to sell
- (e) Processing
- (f) Packaging/presentation
- (g) Seeking contracts

Decisions on markets and marketing have an important knock-on effect on production decisions of what to grow and how to grow it. The scope for communal or group decision-making is worth consideration. Why is maize chosen as the main crop on many schemes?

5. CROP PRODUCTION

- (a) What to grow
- (b) Land preparation treatments
- (c) Planting methods
- (d) Fertiliser use
- (e) Pest control, links with risk and quality control
- (f) Timing

These are all central and important decisions, but they are all linked with markets and marketing, technical information and other productive resources. Timing may also be influenced by availability of inputs.

6. INPUT DELIVERY

- (a) Seeds/ planting materials
- (b) Fertiliser
- (c) Other agri-chemicals/pesticides
- (d) Machinery hire
- (e) Labour hire

Similar decisions to those for product marketing apply, such as where to obtain the input, when to purchase, how to transport, and whether to agree contracts for input supply? Might group buying be advantageous?

7. FINANCE

- (a) Whether to seek credit
- (b) Sources of credit
- (c) Terms and conditions

Finance may be needed for hiring in land or water, improving rural infrastructure, purchasing capital assets and buying inputs, particularly where new crops or methods are introduced. Decisions on how to raise or borrow the finance are clearly important.

8. INFORMATION

- (a) Markets
- (b) Market prices
- (c) Technical knowledge on crop production
- (d) Technical knowledge of servicing and maintenance of machinery and equipment
- (e) Input sources and prices
- (f) Sources of finance and repayment schedules.

Effective decision-making is dependent on having reliable and up-to-date information. Information is essential. Improved communications, possibly using computerised networks, with Senior Subject-Matter Specialists within the Extension Service and other Regional or National Agencies can help. Scheme members should also consider the need for promoting further training of selected scheme members.

5.2 Group responses to questions

Questions

- **What are the main concerns and problems faced in each decision making area?**
- **How are these problems dealt with and how are decisions made?**
- **What are the advantages and disadvantages of making these decisions collectively or individually?**
- **What are the key areas of decision-making areas that require most improvement in the decision-making process?**
- **Are there other important decision-making areas not identified in the discussion document? What and how is it dealt with?**

Broadly, the groups discussed the overall general conditions in the schemes but some consideration was given to problems associated with water use, land tenure and marketing.

Overall, the schemes, particularly those in South Africa and Zimbabwe, were seen as lacking coherent objectives and structures to provide a framework for managing scheme infrastructure or for developing

production and marketing opportunities. Also, they are isolated by the limited education experiences of members and in the use and availability of communications infrastructure, information, and sources of credit.

The participants were concerned about issues associated with traditional land tenure arrangements for individuals on schemes, particularly those in Zimbabwe and South Africa. Tenancy on land allocated to individual farmers by the local Chiefs or subordinate headmen/kraal heads normally provides secure 'rights of occupancy' for farmers and their families. However, some with 'rights of occupancy' do not use their land. In these cases there needs to be a means that will allow such people to retain this right while sub-letting the land for use by others. This will increase flexibility in land allocation, ensure that more land is used productively, and will provide an opportunity for some to extend the size of their farm units. The Swaziland participants indicated that in their case this issue is handled effectively by the local authority.

The main issues on water identified by the participants were installation and operation and maintenance costs of irrigation systems, mechanisms to achieve efficient and equitable water allocation (particularly at times of water shortage) and to control water losses. The participants were also concerned that extraction of water from different sources and dam construction often requires permission from different authorities and ministries.

With respect to marketing, participants identified market information, access roads, poor local market demand, and lack of agri-processing industries as important issues. It was evident that most decision making was undertaken on an individual basis and that there was a low level of trust between farmers so that they found it very difficult to relinquish control over marketing activities. Many groups talked of difficulties in reaching group decisions and further to farmers actually committing to the agreement. There was evidence of competition in the market from farmers on the same scheme. The lack of demand in local markets and the lack of information about conditions and prices in distant markets were both limiting factors.

Although marketing and business orientated farming are seen as significant problem areas for small-scale irrigators, participants identified marketing and production decision-making areas as relatively "easy". This was meant in the sense that they are decisions largely made by individuals and, therefore, 'easier' than making decisions in those areas, such as scheme-level water management and land allocation, that require collective collaboration and consensus.

The advantages and disadvantages of these forms of decision-making were not assessed for the different decision areas but identified in principle. The advantages of collective decision-making were seen as economies of scale in marketing and the potential to strengthen bargaining position. Also collective decision-making through consensus based on a wide range of information and views achieves acceptance and shared responsibility.

Groups referred to different processes of decision-making with respect to land allocation, ranging from collective discussion and consensus achieved through mass meetings and interaction with leadership groups, to decisions based on interactions between traditional leaders and technical specialists. Overall land allocation is mostly not under the control of the land users. In South Africa Ward Committees meet every month and, through the development committees, they can take problems to the Chief. This process has yet to identify a means for people to retain their 'right to occupy' while sub-letting their land to others.

There was some indication that committees or their leaders did not always reflect the best interest of farmers because of vested interests that deflected committee decisions. In the case of decisions relating to water there was a general perception that people, including those on committees, had insufficient information on which to base water-management decisions.

In general it seemed to be the case that participants recognised that group decisions were harder than individual decisions. People were able to address individual decisions confidently but were slow to reach, and often reluctant to commit to, group decisions which could be such a poor compromise as to please no one. Some decisions such as those relating to roads and other communications were seen as beyond the farmers remit and relatively little effort went into attempting to influence those decisions.

5.3 Plenary discussion of group discussion

In the plenary session attention was drawn to the economic viability of the schemes and the need for scheme members to see farming as a business activity and to develop appropriate skills to achieve this. A number of people supported the view that it was inappropriate to seek a welfare component in an irrigation business; schemes should survive or fail on the basis of economic success only. Participants from Swaziland emphasised the community driven nature of smallholder groups and the influence this had on the technology choices that are complementary to existing indigenous knowledge systems. Small-scale, purpose built systems for commercial activities were relatively successful. (This seemed to imply that an objective was present.) Also, such schemes are not saddled with past objectives and non-economic decisions. Reference was also made to the success of joint ventures in South Africa as a possible way forward for smallholder irrigators. These ventures effectively provide for the activities that the farmers find difficult to organise due to the need for collective decisions (transport, advertising, bulk delivery) while providing secure markets, input supply, and technical support. Examples of successful privately decided business ventures were given, highlighting the mix of technologies that could be used to develop successful businesses.

Some groups had identified the need for women and youth to be involved in decision making and it was agreed that these were cross-cutting issues and should apply to all the aspects we covered. The impact of women and youths on the decision-making process was not discussed. Several participants spoke of the need for discipline and this issue was also prominent among comments on the first draft of these proceedings. It was felt that the elected committee and office bearers needed to be vested with authority for their term of office but that re-election should be regular and above board.

6. EXTERNAL RELATIONS

6.1 Discussion paper on marketing and input supply, securing information and services.

The importance of developing external links may be illustrated by comparing the situations represented in Figures 5 and 6. Figure 5 represents a “closed system” of an irrigation scheme established within a community, but with no external linkages. It is assumed that all the products are consumed or sold within the community, while all the inputs are provided from within the community. This gives very little scope for growth and development.

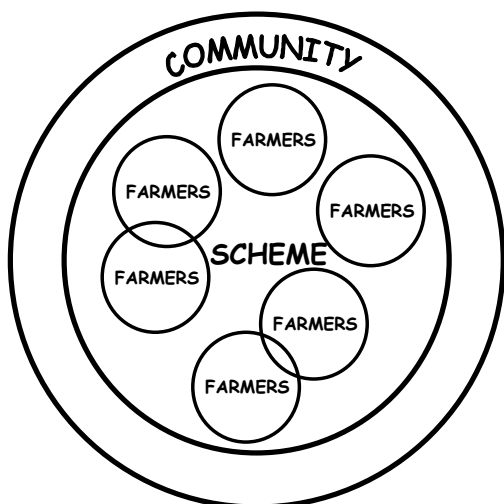


Figure 5 Closed system

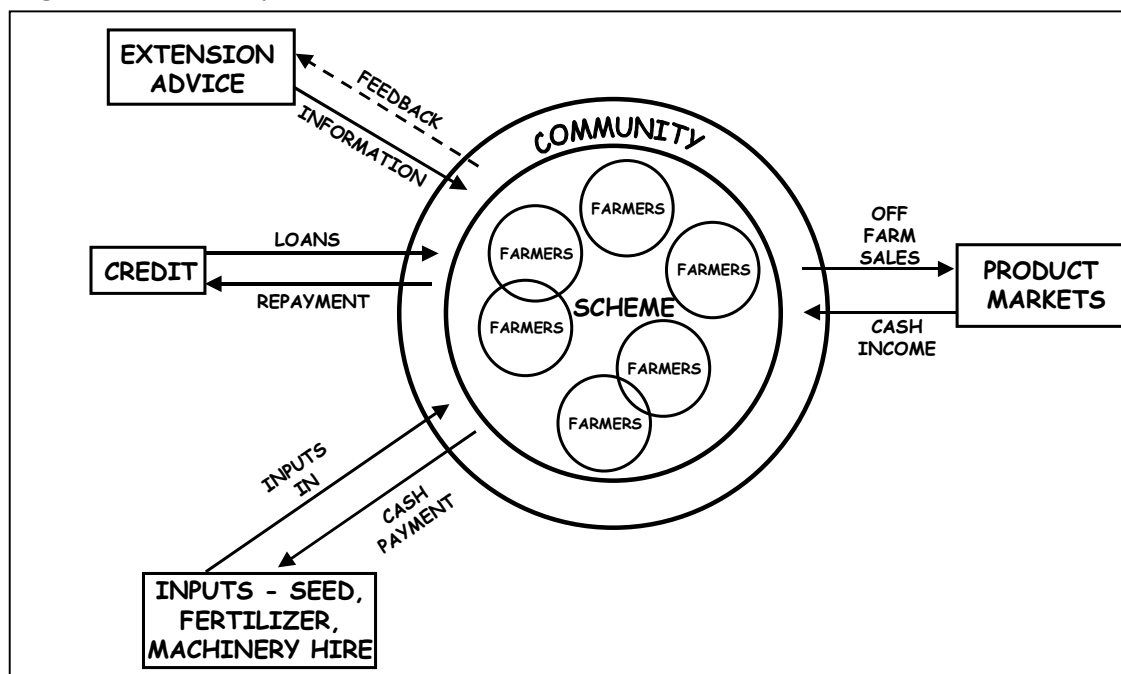


Figure 6 Open system

Figure 6 shows the situation after external linkages have been developed in four main areas:

- Off-farm sales of products;
- Purchase of inputs such as seed, fertiliser, machinery hire;
- Extension advice;
- Credit.

This creates a more “open system” which can expand and develop.

Generally speaking the links with product markets come first. There are many examples, from other parts of Africa, of smallholder farmers responding rapidly to new market opportunities (for example the spread of cocoa in West Africa, and the development of smallholder tea, coffee and milk production in Kenya). However, links with input markets must also be developed for the delivery of the necessary inputs. Extension advice is required for the introduction of new technology and the provision of market information. Finally credit is needed to accelerate the expansion of agricultural production.

All these external links involve outward and inward flows. Farm products flow outwards to the external markets and cash payments for the produce flow inwards. The income received meets the outward flows of payments for inputs and repayment of loans. The flows of information from extension workers to farmers should always be accompanied by the feedback of information from farmers to extension workers about their objectives, constraints and needs.

The links illustrated in Figure 6 really represent longer chains of linkages, as shown in Figure 7.

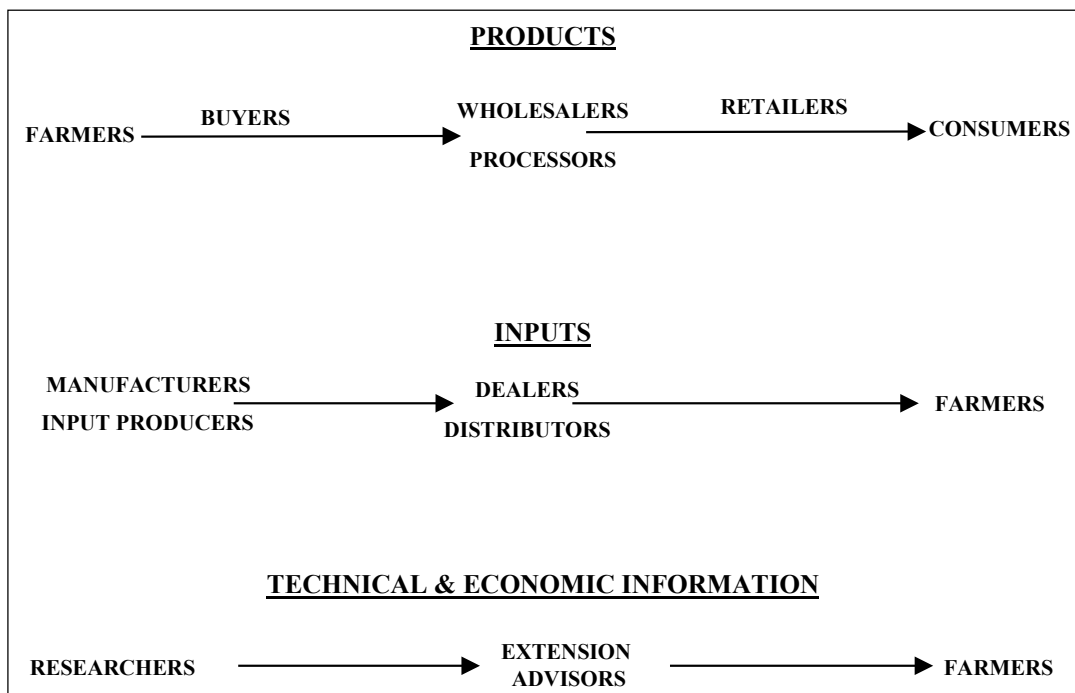


Figure 7 Chains of linkages

For instance the product market chain may extend through several traders, wholesalers and processors before eventually reaching the final consumers in the towns or even in other countries. Likewise there is often a long chain for input delivery from the original producer (the seed breeder or the fertiliser manufacturer), through various intermediaries before they reach the farmer. New knowledge passes through a long chain from the researcher through to the farmer. Credit too is rarely a simple transaction between saver and borrower.

In Figure 7, arrows are shown pointing from left to right, to keep the diagram simple. However, as already noted, all transactions or exchanges involve flows in both directions. Figure 8 serves to emphasise that all transactions involve both a seller and a buyer. They need to get information about each other, what the seller has to sell, in what quantities and what the buyer wants to buy. They need to agree on a price, and possibly arrange a formal contract.

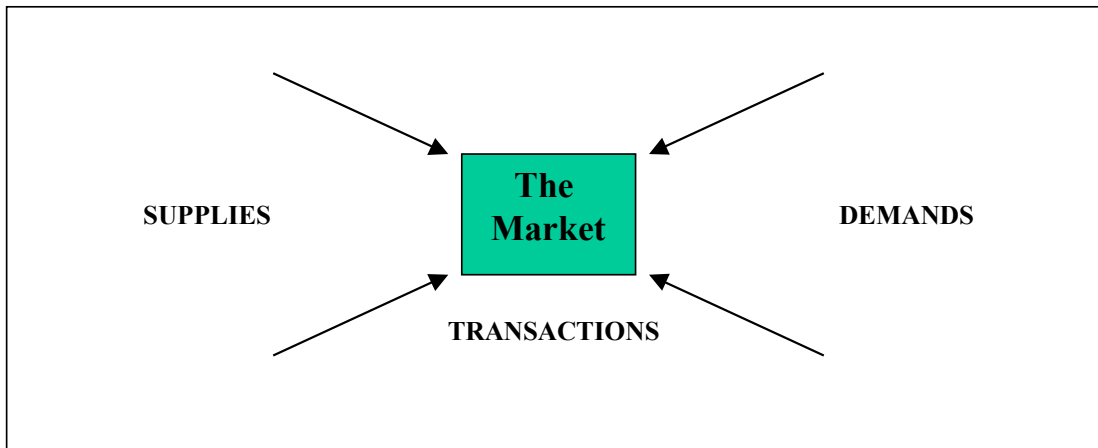


Figure 8 The exchange context

In all this, flows of information are important. The farmer with produce to sell needs not only to seek information about potential buyers but also to distribute information about what is available for sale. It is not enough to wait until a potential buyer comes to the scheme seeking to buy agricultural produce. Scheme members should be pro-active in seeking out information on potential buyers as well as publicising (even advertising) what they have for sale. Similar arguments apply to the search for suppliers of farm inputs and of agricultural credit. In the following discussion the aim is to learn more about the experiences of irrigator-farmers in developing market links.

The main source of technical information, on irrigation and crop production, is often the Extension Adviser. It is highly desirable that they should also be able to offer advice on marketing and farm management. However, most advisers lack training in these areas and are not well provided with information themselves. The following discussion is also concerned with the provision of extension advice.

6.2 Group discussion on external relations

Discussion Questions on External Relations:

1. Are there any benefits from developing links with distant (non-local) markets? What might they be?
2. If there are benefits, how can links be developed?
3. What can be done to get information on market opportunities and prices?
4. Do agricultural extension officers receive up-to-date information on (a) markets and prices (b) new technical recommendations?
5. Do the extension officers have the means and opportunities to pass information on to farmers?
6. What are the advantages and problems faced in selling under contract, or gentleman's agreement?
7. How are purchases of inputs of seed and fertiliser (and maybe machinery hire) organised? Are improvements possible?
8. What type of information and knowledge is most lacking; or in what area is there the greatest need for more information and knowledge?

Are there any benefits from developing links with distant (non-local) markets?

What might they be?

All groups identified positive benefits associated with developing links with distant (non-local) markets. Selling to distant markets increases the scale of the market and generally prices are higher than those found locally. Distant markets provide opportunities to exploit the potential comparative advantage of producing crops unsuited to other areas. The groups also identified the benefits of foreign exchange earnings for overseas distant markets and recognised the broader developmental benefits of access to information and new ideas for innovation from interaction with distant markets.

If there are benefits, how can links be developed?

The groups considered the development of links under four broad headings – communication infrastructure, nature and quality of information, agencies to facilitate links, and training needs. It was agreed that all forms of communication infrastructure are improving in all three countries but more needs to be done, particularly regarding road and tele-communication systems, adequately to link poorer smallholder communities with main markets. Accessibility and quality of information varied within and between the three countries and it was felt that good quality up to date information was generally lacking.

Overall the groups thought that the extension agencies had an important role to play in helping farmers to make connections into the wider market place. This should not be a managing or directing role; the approach adopted should be one that facilitated farmer and community control and direction to encourage ownership and understanding of business-based production and marketing.

Training was seen as a key issue to developing links into the market place.

What can be done to get information on market opportunities and prices?

Suggestions were made that information might be obtained through Extension Agencies and publications in electronic and print media (radio, TV, tele-centres). Timing of agricultural broadcasts is often inappropriate (e.g. 7.00pm). Market agencies may provide information to their clients, while some farmers conduct market surveys and consult each other. However, such approaches are more readily available to commercial farmers than to smallholder communities. Some success in information gathering by smallholders is reported from Swaziland.

Do agricultural extension officers receive up-to-date information on (a) markets and prices (b) new technical recommendations?

Extension Officers (EO) do receive market trends through (electronic) media for major markets in some commercial schemes (e.g. in Swaziland), but generally extension staff do not have up-to-date information on markets. It was suggested that dissemination of market information is easier in a small country like Swaziland; size being an important factor affecting information acquisition. In general however, extension staff does not receive enough initial or in-service training in marketing and their work environment does not afford the opportunity to record market information and trends.

Generally EOs are trained on crop production. In some cases technical information is disseminated from the Training Branch to EOs, or from Research Centres in text form. In addition technical and engineering staff and agricultural scientists render advisory support to EOs. In other cases inter-relationships between research, extension and farmers are rather weak. Extension staff does not always receive up to date information but it is none the less better than no market information.

Do the extension officers have the means and opportunities to pass information on to farmers?

A general problem appears to be lack of facilities such as copiers to duplicate publications and other materials for farming communities while transport is a major constraint. Some EOs are based on schemes where transport may be less of a problem. Most EOs have no telephones and cannot be easily accessed by farmers. Some do have the means to pass on information to the farmers, possibly through field days or the mass media. However, private sector suppliers of inputs and buyers can generally provide better information.

What are the advantages and problems faced in selling under contract, or gentleman's agreement?

Discussion first centred on the advantages of contracts. These are thought to include price and market guarantees which remove market uncertainty (although not in Zimbabwe) expressed in a legal document. The contract may also provide for the supply of inputs, which facilitates planning of farm operations, ensures good agronomic practice and may therefore benefit the whole scheme. Agreement on a fixed price and the exchange of a legal document is seen as potential disadvantages as well as advantages.

Problems with contracts include penalties charged for breach of contracts, being tied down to a fixed price agreed in advance (which may turn out to be below the market price) and the need to meet quality and quantity requirements, due to crop failure for instance. Individual farmers become dependent on the reliability of other group members when they enter a group contract. Doubts were also expressed as to whether farmers are able to benefit from contractual agreements, since they have difficulty in using the legal system, understanding the document and meeting the costs of arbitration.

The advantages of a Gentleman's Agreement are seen as the ease with which it can be arranged, the freedom to negotiate prices although some guarantee is assured because of personal knowledge and trust of the partner in the transaction.

Disadvantages include the fact that it does not represent a documented contract so it is more subject to disputes and conflict, and cheating may occur as the sale is not guaranteed. Uncertainty remains regarding price and quantity and over the actual sale so farmers may fail to gain any security while possibly being paid less than the going market price.

How are purchases of inputs of seed and fertiliser (and maybe machinery hire) organised? Are improvements possible?

In many schemes, farmers contribute to a fund for the purchase of inputs jointly, in bulk. Groups may be organised through a formal committee and assisted by the EO (e.g. some schemes in South Africa), or informal. In other schemes, such as Apel, individual farmers arrange their own purchases of inputs.

Machinery hire is arranged individually in Zimbabwe, but in Swaziland a group hires machinery and ploughing by oxen is done as a group.

Improvements might result from farmers being informed about the quality of service from contact buyers, putting pressure on suppliers to sell bulk at discount, and provision of loans to farmers by giving purchase vouchers. Ideally, irrigation scheme participants should participate jointly to fulfil their objectives at same time in operations such as ploughing, planting, fertiliser spreading hence justifying bulk (collective) purchases with an added advantage of bulk purchase discounts.

What type of information and knowledge is most lacking; or in what area is there the greatest need for more information and knowledge?

One group argued that technical information is most lacking, since research outputs are not disseminated to farmers on a regular basis. However, most were of the view that market information is the most serious deficiency. More information is needed on marketing of high value export products, market research, competitors in production and marketing techniques. Market information should be obtained from a neutral agency, e.g. Government or South African Sugar Association, and provided by a market task force and marketing workshops, until farmers are empowered, to take full responsibility themselves.

Economic and farm management knowledge is lacking, and there is a need for suitable basic business and financial skills training for farmers. A "planning (development) culture" should be encouraged and farmers must recognise the need to be reliable producers in time and quality. Government should encourage input suppliers to deal with small-scale farms where necessary.

6.3 External linkages – Plenary Discussion

Government agencies or NGOs can assist in the process of giving information to farmers. Extension services are better in some countries than others. It is unclear whether this is reflective of theory or practice. Availability of extension is influenced by the size of the country and organisation. e.g. Swaziland is smaller than South Africa or Zimbabwe and benefits from this. Some areas in Zimbabwe are very remote from extension with no phones, transport or copying facilities, so distance and organisations are important aspects of extension. If a high quality extension service exists farmers will be motivated, although good extension is not an end in itself, it can only facilitate access to information. Providing farmers with better market information at the start of the season enables them to plan their planting and crop production.

There should be some system whereby price information can be distributed to all users. In Zimbabwe, a system is being set up where if there is a surplus it can be taken to market areas where there is not enough produce. At the moment in Zimbabwe Agritex publishes producer prices every Friday for nine urban areas. They are now trying to provide information from more rural areas, which will be more useful to urban sellers. In Swaziland Supply Agreements are used instead of contracts and Gentleman's Agreements. These Supply Agreements have been successful as those who complete the contract are given some recognition in the form of a bonus.

Trends in Zimbabwe's market prices should now start being apparent as the marketing group has been established for 2 ½ years. Radios will be used to spread the information to smallholder farmers, but it is unsure whether farmers will use it, as transport to markets is expensive and there is no guarantee of produce being sold even if it is of good quality. Because of lack of consistency in supply, buyers more often than not choose to buy from commercial farmers. A mechanism needs to be devised to increase communication between producers and buyers. If a link can be created with definite transaction details sorted out, this will help both parties. A producer register, made available to interested people, might be a helpful solution.

Subsequent comment queried the validity of any long term involvement of government suggesting that the only long term role-players should be farmer/producers and private sector service providers. The role of government should be in providing an enabling environment. The private sector's willingness to provide services should be seen as a 'test' of sustainability.

Whilst some people thought that the presence of a reliable productive scheme was a stimulus to the market and attracted notice and buyers, others felt that the way forward was to respond to market demand. Participants clearly found this an area in which consensus was difficult.

7. IRRIGATION AND FARM MECHANISATION TECHNOLOGIES

7.1 Discussion paper on irrigation and farm mechanisation technologies

Choices regarding irrigation technologies, and the anticipated levels of farm mechanisation, are made when schemes are first designed or when they undergo major rehabilitation.. A considerable amount has been written about the way these choices affect the management and performance of irrigation schemes. The aim of this discussion paper is simply to note the different areas where choices about technology are made and to promote discussion of how these choices influence farmers' ability to succeed in growing crops for commercial sale.

General questions determining choice of technology:

In considering the choice and use of any irrigation or farm mechanisation technology general questions that arise are:

- (a) **User objectives** – Will the technology be adequate to meet the needs of the farmers? How much system flexibility will the objective require? Does the technology restrict choice amongst the users forcing them to adhere to a fixed pattern of work or does it permit flexibility and independence between users?
- (b) **O & M Costs** How much are people willing and able to pay for their technology? Should cheaper alternatives be sought?
- (c) **Operator skills** – What level of skills is available? Does the technology match the available skills? If not can new skills realistically be acquired?
- (d) **Maintenance** – Is the technology such that it can be serviced or maintained quickly, reliably and locally? Can spares and service components be obtained quickly and cheaply?
- (e) **Replacement costs** - How long will the equipment last and how will a replacement be paid for?
- (f) **Risk** - If part of the equipment or system breaks down, what are the consequences for crop production – does it affect a large part of the scheme for a long period, a small area for a short time or some mid point?
- (g) **Management and support services** – What management is needed to deal with the chosen technology? Is on-going support, from government or an NGO needed or are there alternative service providers?

The following notes examine how these questions relate to a number of specific areas of technology and how they might influence the commercial success of individual farmers and schemes.

Pumps for irrigation

Reliance on any form of motorised pumping to deliver water raises all of the questions above. Some schemes have been successful in taking on full responsibility for the operation and maintenance of a pump but others have encountered severe difficulties. Points to note are:

- a) The scheme may only be technically viable through use of a pump to raise water.
- b) Pumps were often installed during a period when a government agency took responsibility for all aspects of O&M. Changing policy now forces transfer of that responsibility onto the scheme users.
- c) Energy costs are high and rising. To raise sufficient revenue to pay for pump O&M schemes have to charge users high rates, which mean that farmers may have to seek more cash revenue than in the past.
- d) Reliance on pumping carries a high risk. If the pump breaks down a large part of the scheme is deprived of water. Failure of the water supply may affect those growing high value vegetable crops sooner than those growing grain crops or cotton, though all will ultimately suffer.
- e) Electric pumps have much fewer routine maintenance requirements than those using diesel or petrol prime movers.
- f) Private sector agencies offering service and repair facilities tend to provide faster and more reliable service to clients who are known to pay fully and quickly. Thus to retain this good service farmer groups must be able to raise funds quickly and deal on a “commercial” basis.

System layout & water management

Decisions influencing the layout of the scheme, the size and arrangement of individual plots and the procedures in place to plan water allocation can often be traced back over many years to a period when the economic, technical and institutional environment of the scheme were very different from today. Recently completed schemes have a much smaller legacy of “historic culture” and may find it easier to respond to present realities, although this is by no means certain. Apart from this general assertion, other issues that merit debate are:

- a) Does the layout of plots and water allocation plan demand that farmers accept a “scheme-wide” cropping pattern?
- b) Do farmers have opportunity to influence decisions on cropping pattern?
- c) Do technical factors concerning plot layout and water allocation play a large or small role or no role at all, in determining the mix of crops grown and the time of planting?
- d) How are decisions about water allocation made? What freedom do farmers have to decide when and how much to irrigate?
- e) What are the factors that influence the reliability of irrigation supply, does reliability seriously influence farmers’ business decisions and are there any general trends linking scheme type, form of management and consequent reliability of supply?
- f) Compared with other factors that a farmer must take account of when planning what to grow and when – farmer knowledge, supply of inputs, domestic needs, climate, risk of pest and disease, anticipated market demand, etc – does scheme layout and management play a large or small part in planning?

IN-FIELD WATER APPLICATION refers to the way that individuals or small groups of farmers manage and apply water to their crops. Thus, there are distinctions between drip irrigation (uncommon amongst smallholder farmers), overhead sprinkler irrigation, surface irrigation and bucket/watering can methods.

As with the other technology issues reviewed here, the broad choice of in-field irrigation method is made at the time of original scheme design, or rehabilitation / modernisation – individual farmers have little choice, except to the extent that they are consulted during the design process.

The selection of the in-field technology carries a lot of implications with it as the following examples show:

- Use of drip or sprinklers normally requires pumping to provide adequate working pressure;
- Surface irrigation requires more land preparation and grading to achieve efficient water distribution than sprinkler or drip methods;
- Bucket / watering can irrigation is only practical for very small plots;
- Some methods require a greater degree of co-operation between groups of users to ensure effective water distribution or avoid over pressurising pipe networks.

Land preparation

Land preparation is essential before planting any annual, irrigated crop (sugarcane and orchard crops may have different needs for inter-row or inter-tree weed control). This preparation may be done using manual means only, e.g. smaller, communal vegetable gardens, with draught animals or with tractor equipment. The method used is influenced by:

- The size of plot to be prepared
- The in-field water application method
- The local cost and availability of different options
- The extent of land forming required for weed control and water management

Manual plot preparation avoids dependence on any external service provider but because of the physical effort involved it is only practical for small plots where limited soil movement is required for water

management. Reliance on either draught animals or tractors for land preparation raises the following issues:

- a) How long must a farmer wait for land preparation to be complete – do demand peaks mean there are major delays before a farmer can plant?
- b) Is it necessary for several neighbouring farmers to be ready and able to pay for cultivation before the service provider is willing to come to the site? Does this apply equally to animal and tractor draught?
- c) Does the layout of field supply channels restrict access for tractors?
- d) Where government tractor hire services have diminished or ceased what has replaced them and how effective are they?
- e) Where land preparation services are now done on a “commercial basis”, replacing a previous state provided service, what effect, if any, has this had on the way farmers plan their land preparation and try to ensure timely cultivation?
- f) To what extent do concerns over the availability, cost and reliability of land preparation services influence decisions over what types of crop to plant? Are some crops more sensitive to the quality and timing of land preparation, and therefore planting, than others?

7.2 Group responses to questions on farm mechanisation & irrigation technologies

Discussion questions

1. The discussion paper identifies the following areas where technology choices bear upon farmers and scheme managers:

- Use of pumps for water supply
- System layout and therefore water management practice
- In-field water management
- Land preparation

In the schemes you know, which of these has greatest positive or negative impact on farmers commercial success, and why?

2. Do these technology issues play a major or minor role in the production decisions taken by scheme managers or individual farmers, and why?

3. On many schemes technology choices - use of pumps, scheme layout, irrigation method and methods of land preparation – have been taken in the past without reference to the farmers. What practical actions can farmers take to modify these technologies or otherwise make them more suitable to their requirements?

1. Which technologies have the greatest positive or negative impact on commercial success?

High negative impact: Pumps – the high running and maintenance costs and risk of breakdown leading to crop failure can result in serious negative impact. However, it is notable that in the 15 schemes studied all of those classed as “most commercially oriented” relied on pumped water supply.

Neutral impact: Land preparation methods – manual, draught animal power or tractor – were not considered as having a major positive or negative impact by any of the groups.

Positive impact: Good system layout - little was said to expand on this observation.

One group, with experience of low-cost drum kit drip irrigation, identified this as a positive impact due to water saving and improved crop quality.

2. Do these technologies play a major or minor role in shaping decisions?

- Pumps were seen as a critical issue due to the need to raise sufficient income to pay for their O&M. It was also said that if their use led to greater water availability this would also greatly influence the area cropped and what crops were grown.
- Other technology choices may have some influence over the choice of crops grown and their time of planting but generally their impact was seen to be minor in comparison with other factors.

3. What practical actions can farmers take to modify technologies or make them more suited to their needs?

- Farmers have no capital to make major changes to the irrigation and land preparation technologies that they inherit.
- They may seek training or other professional help in order to learn how to manage what they have to best effect.
- Where any re-design or rehabilitation is undertaken full participation of users was stressed as being essential – not merely a token consultation at the outset of the process!
- Establish maintenance funds to cover unforeseen breakdown.
- Develop management and other institutional structures that are consistent with the technology or layout of the physical infrastructure.

7.3 Plenary discussion of group findings

1. The factors most influencing the appropriateness of a technology were felt to be:
 - Purchase and operating/maintenance cost
 - Flexibility – allowing different users flexibility of choice
 - Reliability
 - Serviceability
2. It was observed that farmers may make a poor choice of technology due to lack of good information or the means to make effective economic judgement. For example, they may be attracted to using “high tech” sprinklers when furrow irrigation might be just as effective.
3. The dangers of “token” or passive participation were stressed. Communities need to be fully engaged in all stages of feasibility and design. Design should not be done away from the community with the final product presented to them as a finished job. There is need for regular consultation and input at all stages.

Later comments suggested that attention to efficiency can only be afforded once a minimum level of reliable profitability is achieved .

8. RESEARCH ISSUES

8.1 Objectives

There appears to be a need to demonstrate to farmers, and other players in irrigation, that group objectives and targets can provide tools with which to improve the productive and economic performance of schemes. Even where groups form to address tasks, the objectives tend not to be dealt with in detail but remain at a 'mission statement' level where they are too vague to assist in decision making. Only Lilanda scheme identified a target in its ambition to repay all loans by 2002. This provides the farmers with a very definite statement against which to measure alternative actions.

Would it be helpful to analyse the impact this objective has had on:

- a) The group success*
- b) The individual farmer success.*

It may be helpful to look at the level at which so-called successful schemes have chosen to use group objectives, given that there is a continuum along which objectives can be adopted at group and individual levels. In the case of the schemes surveyed, virtually all farmers market as individuals, whereas many undertake scheme maintenance and input acquisition as groups. Only at one site did farmers group together to provide transport to market. Where this occurred the outcomes are recognised to be broadly successful, but a causal relationship is not necessarily demonstrated.

Would it be helpful to analyse the relationship between group and individual objectives and the economic outcomes for farmers and their families?

Is this appropriate research and would the outcomes be useful?

8.2 Decision-making

The process of decision-making and who are the appropriate people to be involved is a key issue in the success of both production and marketing. It was clear from the workshop discussion that group decisions were so difficult that many farmers rejected them at all levels. However it is also true that to manage a communal system for the common good, agreement must be reached at some level.

*Can research help us to learn lessons from different approaches to decision making and participation?
Can the lessons learned be disseminated to promote better practice?*

The 'economic mindset' was broadly acceptable but there are difficulties in applying it both in concept and practice. The contradiction between economic viability of a business and the welfare impact of schemes was highlighted. It was suggested that government had to decide on support. However, it is also a question for the community and the group management - this may be a factor.

8.3 External links

Links to market information were seen as particularly limiting. Only Swazi sugar-growers were satisfied with their information base. Research on how to improve the distribution and dissemination of market information providing with it sufficient analysis of:

- trends
- consistent seasonal characteristics
- differences associated with location
- impact of product differentiation on price.

could provide some guidance for policy makers and providers of information.

How useful is this?

Facilitation of supplier-producer-buyer links was emphasised in the external links session but the question of how to put into practice such facilitation remains unanswered. There is likely to be a number of successful strategies from which schemes and agencies could select. Recognition of farmers and buyers as valid stakeholders in the market might be key requirements, as would the two-way flow of information from farmer to buyer and buyer to farmer, allowing planning to take place. Contributions from both sides need to be relevant, possible and affordable.

Would research in this area contribute significantly?

8.4 Technology choices

The lack of good information relating to the economic aspects of the technologies that are on offer, limits the ability of farmers to make appropriate choices. Farmer access to non-biased, reliable, economic evaluation of infrastructure and equipment is very limited indeed which constrains their ability to participate. To supply and update information is probably not a realistic or affordable option, however it may be possible to assist farmers in developing a systematic approach to deal with the situation.

Would it be helpful to work on a checklist to assist farmers or farmer committees to acquire and handle capital and recurrent cost data for irrigation options?

8.5 Cross cutting issues

1. In the course of the discussions differences in the institutional structure of schemes became apparent. Not only are there differences between countries in agricultural policy and the planned administrative structure of irrigation schemes but also between the various Government and Non-Government Organisations involved. Scheme size is one aspect which may depend upon, but may also influence, the choice of administrative structures.

Differences may well be linked with different development objectives, such as food security or commercial gain. In all cases, greater farmer participation is an important aim. However, given these differences in objectives it would be inappropriate to attempt a comparative assessment of scheme performance in terms of a single objective.

Nevertheless can useful lessons be learned from a more detailed study of the administrative structure and organisation of the different schemes included in this project?

2. Training was mentioned at various points in every session and emphasised in relation to marketing techniques, handling of contracts and planning. However the question still remains as to what are the key skills in which training should and could be given in order to improve the sustainability of smallholder irrigated farm businesses or small and medium enterprises.

What training materials need to be specifically developed for the smallholder irrigator's environment in Southern Africa?

In addition it may be useful to consider the best target audience and how training would best be delivered. The key role of the extension service was referred to frequently as was the strain upon extension services of significant reduction in available funds for training and logistic support.

3. Gender aspects were not discussed although there was an appreciation of the additional constraints faced by women farmers, particularly relating to transport. The issue of local and distant markets received more attention but the gender aspect was not specifically mentioned in relation to distance.

9. DRAFT RESEARCH PROPOSED

The research proposed in each country would be expected to shed light on all the research issues identified in section 8. However, the emphasis would differ as does the character of the scheme and environment.

South Africa

In South Africa there are significant problems associated with establishing appropriate objective and decision-making processes. Historically smallholder irrigators have been restricted in their activities and therefore in the links they have been able to make with suppliers and markets. As Government support is withdrawn from their farming system it is particularly important for them to develop business mindset and expertise over a short period of time. The activity of many different Ministries and Departments in rural areas can lead to confusion and adds to the difficulties of the stakeholders in being clear about their objectives. The research therefore must look at the fundamentals of how irrigators participate in and organise the 'scheme' activities. It is also important that training should address fundamental economic and business principles.

A scheme will be selected on which to investigate the mechanisms by which members and their families become involved in deciding scheme objectives and to identify the constraints and opportunities that influence participation in a range of decisions. Analysis of how individuals contribute to communal decisions that will support their own commercial goals and those of the scheme at large. The investigation would aim to analyse the impact of participation and agreed objectives on the development or farmer committees' ability to monitor their own progress and to use the feedback thus generated in managing the scheme satisfactorily and further improving their techniques.

Swaziland

It appears that information flows in Swaziland are such as to provide better support to smallholder farmers than in either South Africa or Zimbabwe. Physical compactness and institutional characteristics are thought to be a significant factors. Particular attention will be given to investigation of information collection and dissemination, the processes used in acquisition of market information ,and responses in terms of market practice. It is expected that this will involve qualitative information collection over a range of circumstances. It is expected that the investigation will analyse production decisions such as crop choice and timing and the level of support demanded from agency and private sector to enable commercial success. Comparison of these processes in the sugar and horticultural sectors may shed light on key issues.

Zimbabwe

In Zimbabwe attention is already being focussed by AGRITEX on market information systems at the larger smallholder schemes associated with government support services. Very small schemes often fall outside this sphere and do not benefit. There is potential to assist this group of irrigators by investigating local and distance marketing in small community based schemes where there is limited potential and high cost associated with commercial linkages with distant markets. Particular attention to marketing strategies and interactions with the local community and local businesses would be crucial to the research.

There is potential for this research to build on lessons learned in the already commercialised smallholder sector, particularly in relation to information delivery and training and also the work already done by CARE in developing their marketing modules. CARE are sensitive to the parallel development of social capital in the rural communities to support the success of training. Their proposed programme of monitoring and evaluation could potentially be supported by the project activities in this area.

Annex 1

Summary of field visit to Dingleydale

Annex 1 Summary of field visit to Dingleydale

A field visit to an irrigation scheme was organised on the morning of June 27th. Participants were briefed on the changes in irrigation management taking place countrywide, giving Dingleydale as an example.

Rex Mtileni, the Deputy Director of the Agricultural and Rural Engineering Program said that initiatives have been taken in areas of public works and public health in the country. Today, for 171 irrigation schemes, 500 million Rand were needed annually for operation and maintenance, out of which 19 million Rand would be used for diesel supply only. He said that the government was aware that changes could not be made over-night, especially since management needs to be transferred to an existing framework or institutions that are already in place. However, the decision to relinquish ownership to farmers had already been taken, as he said, “government is not a farmer, farmers should do farming and governments should do policy development”. He further explained that in order to implement these decisions 11 irrigation schemes had been selected as pilot projects from which they hope to learn and replicate the lessons to all other schemes in the Northern Province. In doing so, the government is collaborating with researchers, such as, ARC and IWMI, bringing together a field of experts to help them implement these policies. He stated that they have a lot of questions but the answers are still being researched for!

Development Process of Loxton Venn & Associates

Following this was a presentation of the Dingleydale irrigation scheme by Jon Rutherford, Director of Loxton, Venn & Associates. The scheme consists of 1650 ha, consisting of 1200 farmers and 1.3ha per farmer. He went on to talk about the three main principles that applied to their approach, which are:

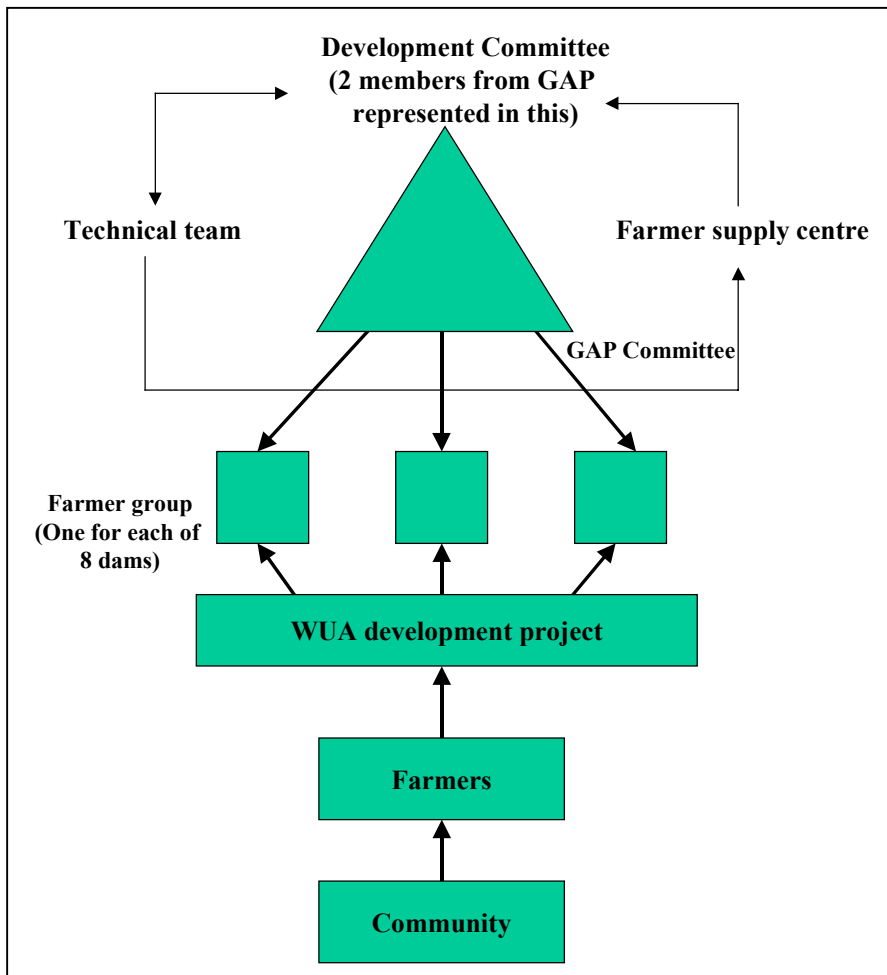
- Need for legal entity to transfer the structure to people themselves, the entity being the water users association. (It has the flexibility to be an entity, even if not a perfect one.)
- To establish a legal entity that can provide a framework in relation to water & agricultural management.
- Community must have maximum involvement in this process.

In relation to the last point, it appears much harder to set up a management structure while dealing with a complex project like that of Dingleydale. Government has provided most operation and maintenance (O&M) until now, but since this is not sustainable in the long term, one needs to ask how one is to hand over management on such a scale to people in extreme poverty with a predominantly elderly population with very little education. Jon stressed the aspects of a ‘people lived, people owned and people provided’ approach. Once these institutions are in place, capacity building and training are key factors that will enable the community to operate in the best way and maximise outputs, which includes establishing structures, defining responsibility and allowing people to take over. He explained that the process of transfer, passing over responsibility for management, is a gradual one. He stated that government would rehabilitate structures to allow the schemes to be managed by the farmers, so long as the farmers ‘decide’ to take on the responsibility of scheme management. This rehabilitation would be limited to fundamental irrigation structures. He also mentioned that as facilitators another responsibility of Loxton Venn is to take the community by the hand and assist them to become self-sufficient and sustainable. This was important, especially since these schemes vary enormously in nature from individual management to absolute government responsibility. Changing the mindset of the people was going to be very difficult. In addition, the question of whether the community can meet these demands both in terms of management and money was stated, especially since there is no guarantee of success and hence a huge challenge to the community. It is a people driven process resulting in rejuvenation of irrigation schemes resulting in better livelihoods.

Aims of Loxton Venn & Associates in relation to its activities:

- Looking at an established institutional structure
- Rehabilitation
- Agricultural upliftment. It is people developed and aims to empower people with a goal for people to manage scheme ownership.

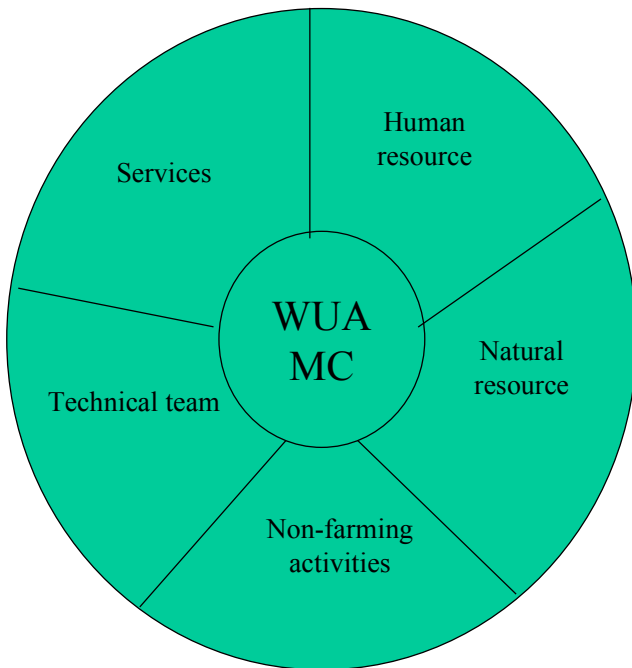
Management structure put in place by farmers (Dingledale Chairman)



Discussion

The discussion that followed raised some interesting issues, for example addressing the needs of all groups for water (even those who are not farming), and other questions regarding land allocation procedures in the area. In relation to Loxton, Venn & Associates’ rehabilitation work, questions regarding the financial viability of the scheme and the process of water charges were raised. Everyone with land is said to be paying 12 Rand annually but water pricing had not yet been implemented. As far as the question of sustainability was concerned, he felt that the minimum farmers will have to pay for is maintenance of infrastructure, but there is likely to be a government subsidy on water for a while.

Structure of Water Use Association Management Committee.



Annex 2

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Annex 2 Participants List

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Annex 4

Supplementary analysis

Annex 4 Supplementary analysis

SIBU data set 2001

In this part of the analysis qualitative information related to aspects of production and marketing was processed, categorised and analysed. Questions dealing with the importance of different crops, factors that affect crop choices and amounts grown were examined. Additionally factors that determine prices, sale of produce to local and distant markets and key problems & constraints were also documented (Table 2).

All these aspects require different levels of decision-making, some at individual level, other decisions may result from intra-household bargaining, groups decisions or co-operative or scheme-level agreements etc. For instance, choice of crop to grow is an individual decision, however, this decision is influenced to a great deal by market, demand, timing, availability of resources etc. All this makes it a very complex picture with different levels of consultation and decision making.

While looking at the factors that farmers took into consideration in choosing crops to plant, not surprisingly market conditions were a paramount consideration, over 70% of farmers mentioned them in two of the schemes of Zimbabwe, (figure 1). In South Africa there was more emphasis on home consumption than in Swaziland and Zimbabwe. Consistent with this was the emphasis that Zimbabwe farmers gave the need for market information and support services. Swazi farmers gave varied replies concerning information needs and in the workshop related a relatively satisfactory situation regarding market information. In general, the primary constraints identified in relation to marketing were transport, infrastructure and various aspects of production. Whereas other limitations included external linkages, social aspects (theft) and management problems (the latter was only visible in South Africa, which appears logical due to the changes in the management of transfer). Most of the problems and constraints mentioned directly affected selection of crops.

Size of the plot might have been expected to have a bearing (Table 3). However, those who sited home consumption as an objective were evenly spread throughout the plot-size range, It seems that the home consumption may relate to marketing difficulty and general poverty levels. This could not be substantiated from the available data. The gender of the plot-holder had a relatively small impact on choice between subsistence and commercial crops. Over all both men and women produced for similar reasons, mainly home consumption or income generation. However minor differences are visible in Figures 5 and 6. Men are more inclined to produce for income generation purposes (especially in Dingledale A and most of the schemes in Zimbabwe). Women produce both for home consumption and income generation without much strong preference. While looking at these graphs it is important to keep in mind the gender count on Table 1, to avoid misleading results.

For example, in Figure 6, Strydkraal has only 2 female respondents hence giving a rather skewed picture. It shows that the 2 women in that scheme are much more cash oriented than the men. One man used irrigated produce as an input to a livestock enterprise otherwise the remainder grew mainly for home consumption. This data suggests that women are as strongly motivated by cash returns as are men and challenges the assumption that women produce mainly for subsistence or perhaps challenges the narrow definition of subsistence.

Most respondents sold to local rather than distant markets, this is visible in schemes in Zimbabwe more than in Swaziland and South Africa (Figure 3). The reasons for selling to locals include the convenience associated with selling directly from the plots to local customers, traders, and hawkers rather than transporting produce to distant places. In most cases distant marketing is complicated by lack of information, and transport and is often consciously avoided. In schemes where the market was distant, only 20% of respondents showed a high demand for information unless farmers were keen to break into distant markets. Farmers who lack immediate commercial goals, either as a result of distance from markets or lack of commercial links or lack of knowledge were concerned with production issues.

The analysis considered how the farmers viewed determinants of price. We gained insight into the extent to which price was seen to be determined by outside factors such as the number of competitors or factors within farmers control such as quality and quantity of the product (Figure 4). Farmers who work on small plots below 0.5 ha seemed significantly more aware of quality as a determinant of price than those dealing with larger areas and presumably larger volumes. This perception may be affected by the activities of NGO staff as all NGO assisted schemes mentioned quality and all happen also to have very small plot sizes (table 3). Farmers having immediate contact with all they produce maybe more readily aware of quality, assuming that on bigger irrigated areas labourers may harvest rather than farmers themselves. Linked also to quality is concern with production issues and weather. The small number of schemes (13%) that mentioned water, were also voicing a quality concern.

Water and credit, often regarded as key concerns, were not given prominence by the farmers, only 13% mentioned credit. However, finance generally, was particularly mentioned in South Africa.

Over all, the data reveals no striking surprises. In relation to their degree of commercialisation, farmers show a gradation of interest in market access, information and support. Among the least commercial production issues dominate but among the most commercial, information and market access are prized. These characteristics (Table 2) support Phase II research into the best and most affordable way to meet information and access needs.

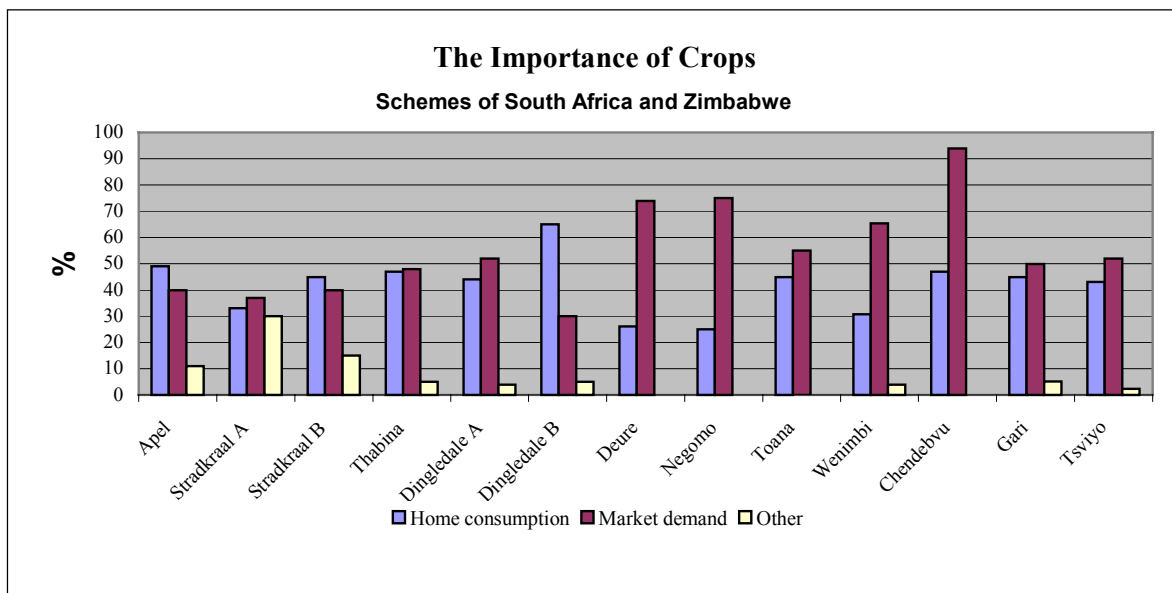


Figure 1

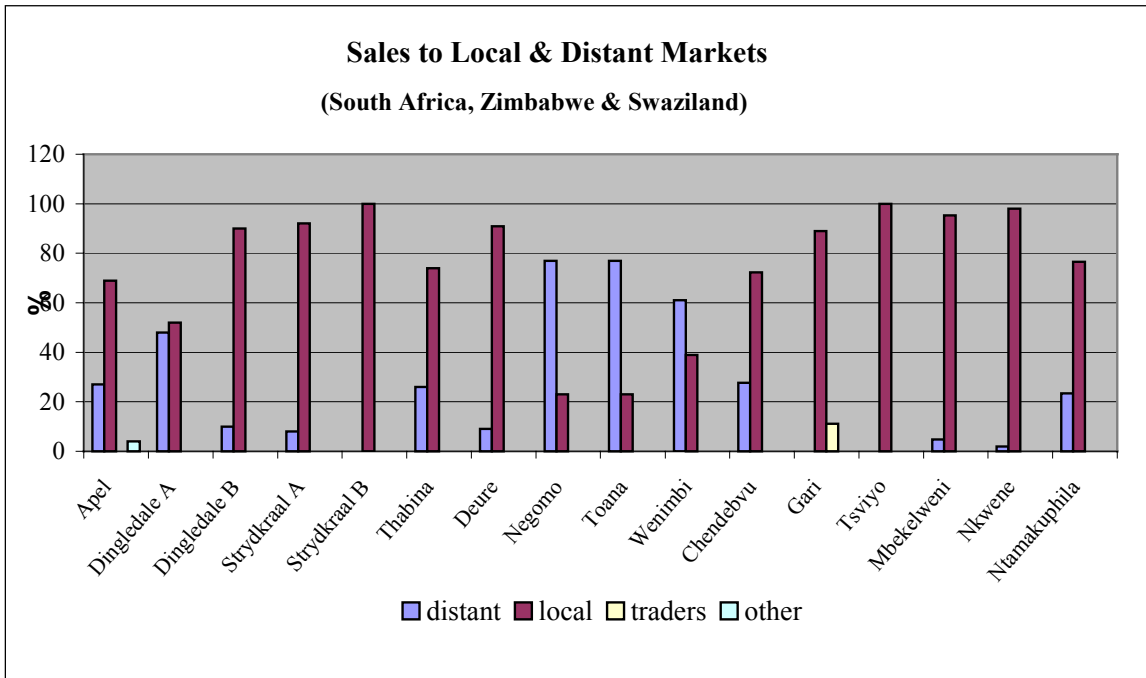


Figure 2

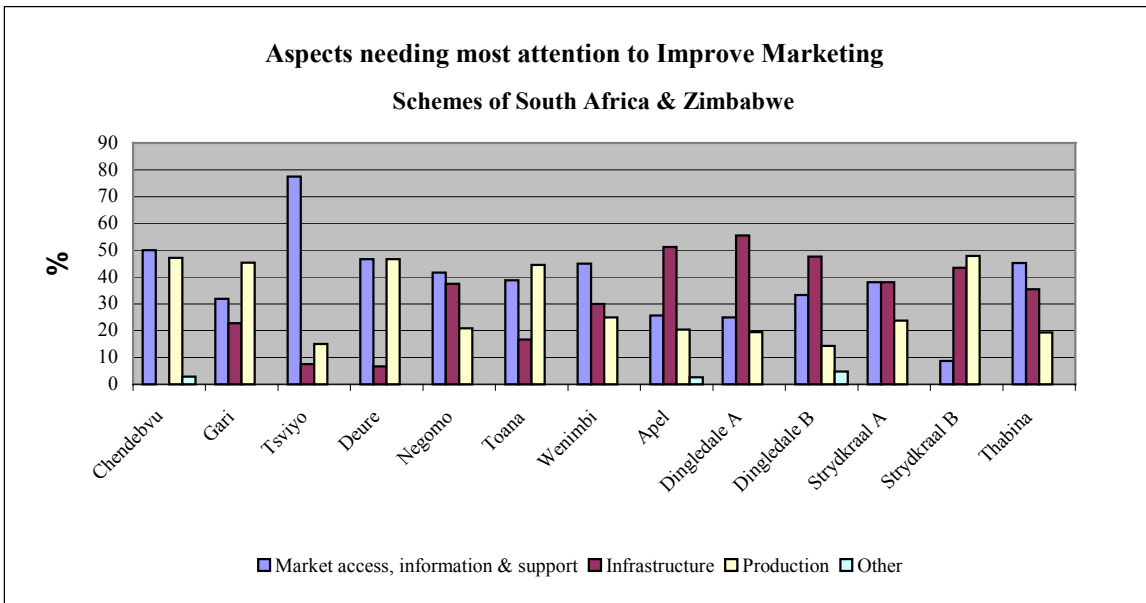


Figure 3

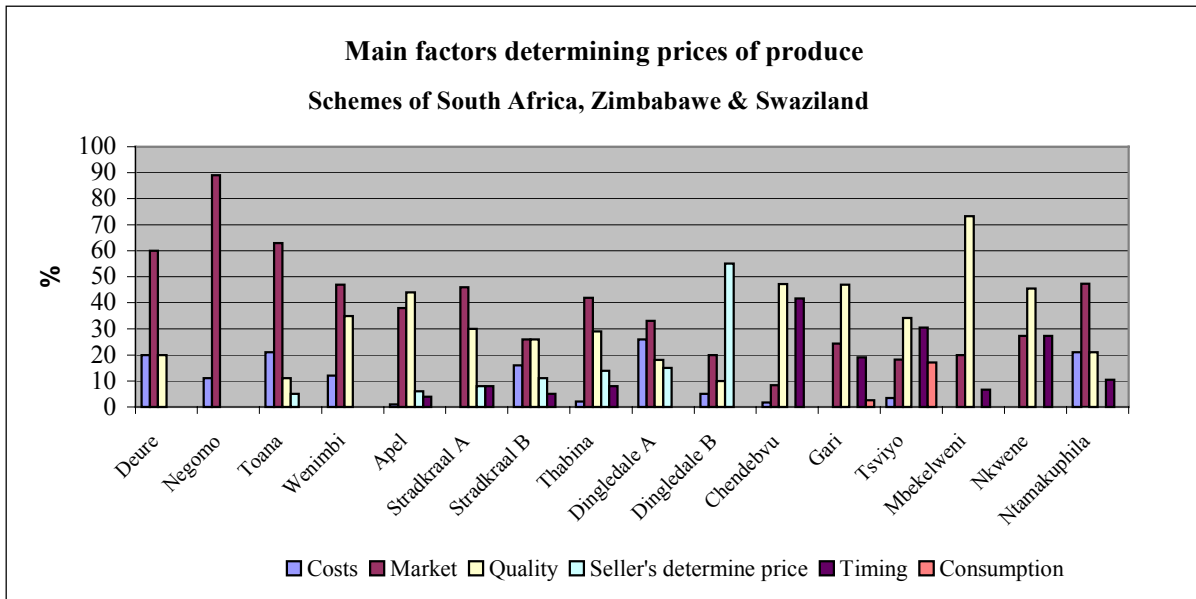


Figure 4

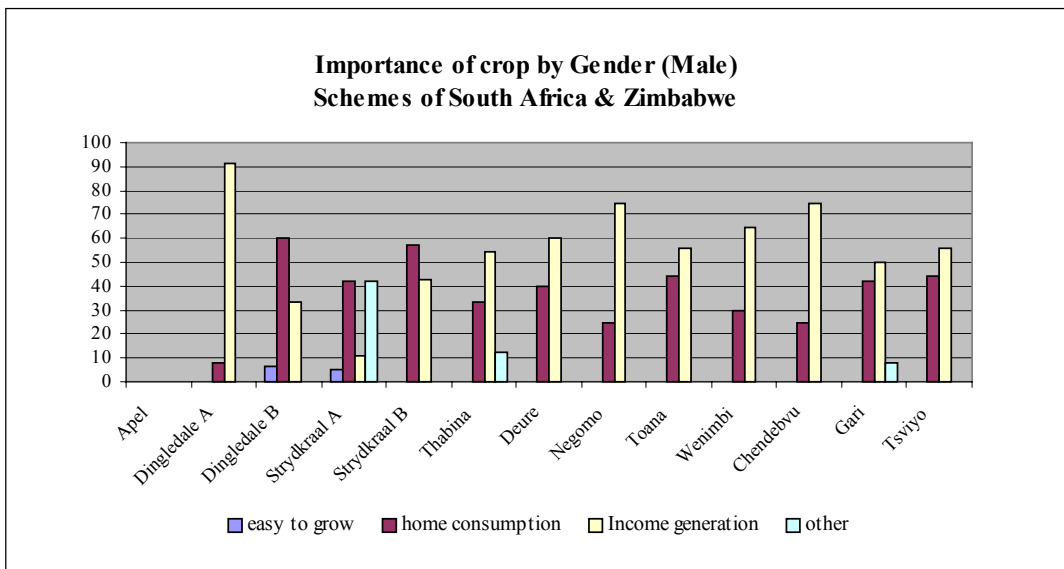


Figure 5

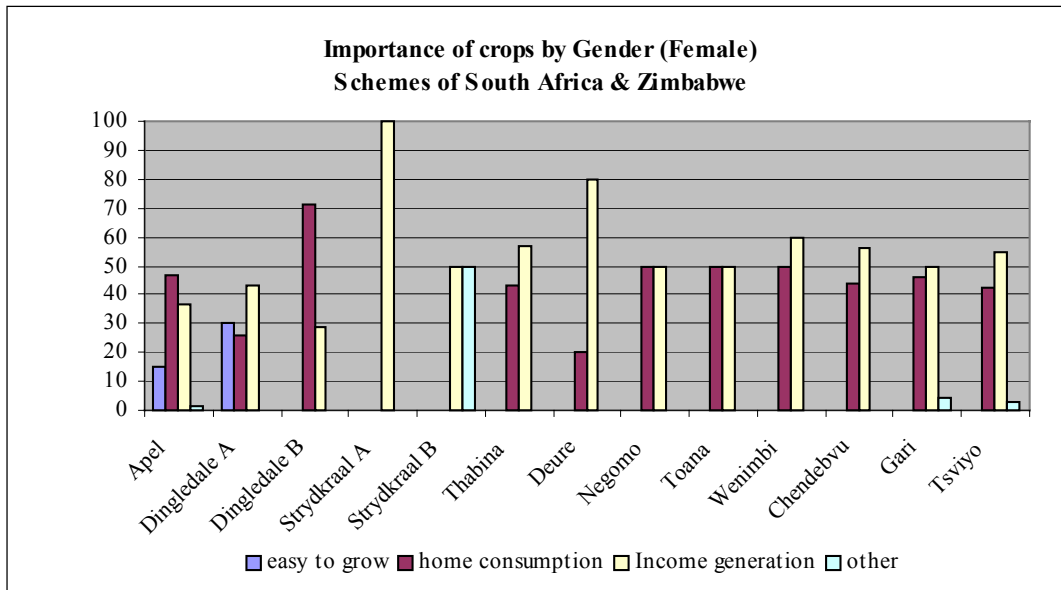


Figure 6

Table 1 Gender Count in all the schemes of South Africa, Zimbabwe and Swaziland

South Africa Schemes	M	F	Zimbabwe Schemes	M	F	Swaziland Schemes	M	F
Apel	0	16	Denure	5	5	Ntamakuphila	11	6
Dingledale A	8	10	Negomo	6	4	Nkwene	2	10
Dingledale B	12	3	Toana	5	5	Mbekelweni	6	9
Strydkraal A	8	2	Wenimbi	7	3			
Strydkraal B	1	9	Chendeovu	1	8			
Thabina	9	11	Gari	3	8			
			Tsviyo	2	8			

Table 2 Schemes Sorted Out By Country

												ZIMBABWE						SWAZILAND					
SOUTH AFRICA																							
	Apel	Thabina	Dingleydale	Strydkraal A	Denure	Taona	Wenimbi	Negomo	Gari	Tsviyo	Chendebyu	Mbekelweni	Nkvene	Ntamakuphila									
Importance of crops, Why?	Food	Market demand	Market demand Food	Market demand Food	Demand	Demand	Demand	Demand	Money	Money	Food Money Demand	*	*	*									
Factors affecting crop choice	Production	Production	Food Demand	Demand Production water	Extension Profit	Profit	Production	Food Demand	Production	Production	Production	Labour	Weather	Weather									
Factors affecting amount grown	*	*	*	*	*	*	*	*	*	*	*	Season Timing	Resource	Decide in group meeting									
Factors determining price	Quality	Market	Market Sellers	Market Quality	Market	Market	Market	Market	Quality	Quality	Quality	Quality	Quality	Demand									
Main Customers	Local	Local	Local	Local	Local	Distant	Distant	Distant	Local	Local	Local	Local	Local	Local Distant									
Special problems	Production	Infrastructure	Finance Management	Finance Production					Transport Market	Capital Transport	Capital Transport Weather	Competition Transport	Production Social	External linkages Transport									
Aspects needing attention	Infrastructure	Market Access	Infrastructure	Market Infrastructure Production	AIS Production	Production	AIS	AIS	Production AIS	AIS	Production AIS												

* The scheme was not asked this question

• AIS: Access, information and support

Table 3 Schemes Sorted By Plot Sizes

	Plots < 0.5ha										Plots 0.5 - 1.5ha				Plots > 1.5ha		
	Apel	Gari	Tsviyo	Chendebyu	Mbekelweni	Nkwene	Ntamakuphila	Denure	Taona	Negomo	Strydkraal	Thabina	Dingleydale	Wenimbi			
Importance of crops, Why?	Food	Money	Money	Food Money Demand	*	*	*	Demand	Demand	Demand	Market demand	Market demand	Market demand Food	Demand			
Factors affecting crop choice	Production	Production	Production	Production	Labour	Weather	Weather	Extension Profit	Profit	Food Demand	Production	Production	Food	Production			
Factors affecting amount grown	*	*	*	*	Season Timing	Resources	Decide in group meeting	*	*	*	*	*	*	*			
Factors determining price	Quality	Quality	Quality	Quality	Quality	Quality	Demand	Market	Market	Market	Market	Market	Market Sellers	Market			
Main Customers	Local	Local	Local	Local	Local	Local	Local Distant	Local	Distant	Distant	Local	Local	Local	Distant			
Special problems	Production	Transport Market	Capital Transport	Capital Transport Weather	Transport Competition	Production Social	External Linkages & Transport				Infrastructure	Infrastructure	Finance	Management			
Aspects needing attention	Infrastructure	Production AIS	AIS	Production AIS				AIS Production	Production	AIS	Market Access	Infrastructure	Infrastructure	AIS			

* The scheme was not asked this question

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Table 4 Schemes Sorted By Levels Of Commercialisation

	Highly commercialised		Moderately Commercialised			Minimally commercialised						Unknown		
	Wemibi	Negomo	Thabina	Dingleydale	Denure	Taona	Gari	Tsviyo	Chendebyu	Apel	Strydkraal	Mbekelweni	Nkwene	Niamakuphila
Importance of crops, Why?	Demand	Demand	Market Demand	Market demand Food	Demand	Demand	Money	Money	Food Money Demand	Food	Market demand Food	*	*	*
Factors affecting choice of crop	Production	Food Demand	Production	Demad Food	Extension Profit	Profit	Production	Production	Production	Production	Demand production	Labour	Weather	Weather
Factors affecting amount grown	*	*	*	*	*	*	*	*	*	*	*	Season Timing	Resource	Decide in group meeting
Factors determining price	Market	Market	Market	Market/Sellers	Market	Market	Quality	Quality	Quality	Quality	Market Quality	Quality	Quality	Demand
Main Customers	Distant	Distant	Local	Local	Local	Distant	Local	Local	Local	Local	Local	Local	Local	Local Distant
Special problems			Infrastructure	Finance Management			Transport Market	Capital Transport	Capital Transport Weather	Production	Finance Production	Transport Competition	Production Social	External linkages Transport
Aspects needing attention	AIS	AIS	Market Access	Infrastructure	AIS Production	Production	Production AIS	Production AIS	Production AIS	Infrastructure	Market Infrastructure Production			

- * The scheme was not asked this question
- AIS: Access, information and support

Table 5 Schemes Sorted By Key Constraints

	Water		Credit/Marketing					Marketing							Unidentified		
	Apel	Tsviyo	Chendebyu	Wenimbi	Strydkraal	Gari	Ntamakuphila	Mbekelweni	Nkwene	Thabina	Dingeydale	Denure	Taona	Negomo			
Importance of crops, Why?	Food	Capital	Food Money Demand	Demand	Market demand Food	Money	*	*	*	Market demand	Market demand Food	Demand	Demand	Demand			
Factors affecting choice of crop	Production	Production	Production	Production	Demand Production	Production	Weather	Labour	Weather	Production	Demad Food	Extension Profit	Profit	Food Demand			
Factors affecting amount grown	*	*	*	*	*	*	Decide in group meeting	Season Timing	Resources	*	*	*	*	*			
Factors determining price	Quality	Quality	Quality	Market	Market Quality	Quality	Demand	Quality	Quality	Market	Market Sellers	Market	Market	Market			
Main Customers	Local	Local	Local	Distant	Local	Local	Local	Local	Local	Local	Local	Local	Distant	Distant			
Special problems	Production	Capital Transport	Capital Transport Weather		Finance Production	Transport Market	External linkages Transport	Competition transport	Production Social	Infrastructure	Finance Management						
Aspects needing attention	Infrastructure	Production AIS	Production AIS	AIS	Market Infrastructure Production	Production AIS			Market Access	Infrastructure	AIS Production	Production	AIS				

* The scheme was not asked this question

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Table 6 Schemes Sorted By Management Type

	Farmer		Farmer/NGO				Farmer/Agency			Agency			Unknown		
	Apel	Wenimbi	Tsviyo	Chendebyu	Gari	Thabina	Dingleydale	Strydkraal	Denure	Taona	Negomo	Mbekelweni	Nkwene	Ntama-kuphila	
Importance of crops, Why?	Food	Demand	Money	Food Money Demand	Money	Market demand	Market demand Food	Market demand Food	Demand	Demand	Demand	*	*	*	
Factors affecting choice of crop	Production	Production	Production	Production	Production	Production	Demand Food	Demand production	Extension Profit	Profit	Food Demand	Labour	Weather	Weather	
Factors affecting amount grown	*	*	*	*	*	*	*	*	*	*	*	Season Timing	Resources	Decide in group meeting	
Factors determining price	Quality	Market	Quality	Quality	Quality	Market	Market Sellers	Market/Quality	Market	Market	Market	Quality	Quality	Demand	
Main Customers	Local	Distant	Local	Local	Local	Local	Local	Local	Local	Distant	Distant	Local	Local	Local	
Special problems	Production		Capital Transport	Capital Transport Weather	Transport Market	Infrastructure	Finance Management	Finance Production				Competition Transport	Production Social	External linkages Transport	
Aspects needing attention	Infrastructure	AIS	AIS	Production AIS	Production AIS	Market Access	Infrastructure	Market Infrastructure Production	AIS Production	Production	Production AIS				

- * The scheme was not asked this question
- AIS: Access, information and support