

The Practice of Smallholder Irrigation

Case Studies from Zimbabwe



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ISBN 0-908307-51-9

Published in 1996 by
University of Zimbabwe Publications
P. O. Box MP 203
Mount Pleasant
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Cover photo from the National Archives of Zimbabwe
Cover photo sketch by Bryan Pillay

Typeset by University of Zimbabwe Publications
Printed in Zimbabwe by Mazongororo Paper Converters (Pvt.) Ltd., Harare

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Challenges of independence

Managing technical and social worlds in a farmer-managed irrigation scheme

Nyasha Matsika

The performance of the Zimbabwean economy is directly related to that of the agricultural sector, with the economy doing well in a good agricultural year. Irrigation has become of paramount importance due to erratic and changing rainfall patterns. In times of drought, the majority of the population that relies on dryland agriculture are hardest hit (Magadzire, 1994).

Since the 1940s, colonial and post colonial governments have recognised the importance of water development, emphasising in particular dam construction in large-scale commercial areas. As a result, the large-scale commercial sector is enjoying the benefits of this long-term strategic investment. After independence, the Government gave more recognition to the potential of irrigation, extending it to smallholder irrigation. Irrigation for smallholders serves to achieve many purposes:

- (1) it enables double cropping and hence efficient utilization of two scarce resources, land and water;
- (2) it contributes towards the achievement of food security in marginal rainfall areas, and where mid-season droughts are experienced;
- (3) it makes higher yields attainable;
- (4) it improves farm incomes and standards of living; and
- (5) it earns the country foreign currency through the export of surplus and cash crops and/or import substitution.

Irrigation development has therefore been given top priority. The majority of the schemes established were managed either by Agritex or ARDA.

~~In communal and resettlement areas the majority of irrigation schemes are managed by Agritex. This often implies that farmers are passive beneficiaries, where management and decision-making is the responsibility of government officials: they are responsible for drawing up and implementing cropping programmes, enforcing by-laws and indirectly influencing the market by promoting certain crops in~~

f. Government's interests. In Agritex schemes, government further controls water through the water bailiff system, and also administers scheme maintenance.

However, out of circumstance more than design, a few irrigation projects were left from the beginning to be farmer-managed. One such scheme is the Mundotwe Irrigation Scheme in Bindura District of Mashonaland Central Province. This scheme offers an opportunity to learn from the experiences of irrigators managing their own affairs. The insights gained could be very helpful, since sustainable irrigation development depends on the beneficiaries being actively involved in managing the schemes. It is important to note that the Mundotwe scheme was implemented under the responsibility of the Bindura District Administration, though Agritex was actively involved from the start.

THE MUNDOTWE IRRIGATION SCHEME

The scheme derives its name from the Mundotwe stream, a tributary of the Mubvinzi river. The river constitutes the boundary between Musana (Mashonaland Central) and Chikwaka (Mashonaland East) Communal Areas. A dam was constructed on the Mundotwe stream and its water was eventually used for irrigation. The Mundotwe Scheme is 60 km north-east of the capital Harare, along the Harare-Shamva road. The area enjoys reliable rainfall of between 750 to 1000 mm per year in a normal year. The scheme was set up to provide full-time employment and resources independent of dryland agriculture for local cultivators and to provide some relief of population pressure in the crowded communal area.

The idea of establishing an irrigation scheme stemmed from the availability of the under-utilised water of the Mundotwe dam, with its capacity of 480,000 m³. The dam had been constructed with the intention of providing piped water to the nearby township and domestic water to the surrounding villagers. However, the business community of the township were not prepared to pay for the water and expected it to be provided free of charge. As a result, the dam was under-utilised and Agritex and Local Government officers agreed that an irrigation project would be the most beneficial way to use the water. Agritex was then given the task of identifying blocks of land suitable for irrigation within the area. Two blocks were identified as being the best sites. Funds for the implementation of the project were secured and released through Public Works projects administered by the District Administrator's office. The design, supply of all the necessary irrigation equipment and the installations were contracted to a local engineering firm, Stewarts and Lloyds. The work started in March 1987.

During project implementation, the farmers were involved in trench digging and refilling, in brick moulding (to build the store) and in stumping and clearing the fields. One might ask who these farmers were and why they became involved? Since the designated blocks were already being cultivated, it was logical to give the first

chance to the current land users. However, it took a lot of time and effort (through meetings and field trips to other schemes) to persuade a handful of them to finally agree to participate in the irrigation project. Many of the farmers were not agreeable to this:

- some believed that they would become government labourers as they viewed the project as belonging to the government (having seen Agritex and ARDA-managed schemes);
- some feared that the state could take the land away from them at any time, since they would not hold any title deeds to the land but only user rights; especially if they were to perform below the expected standards;
- some thought they would not cope with the all-year-round activities required in an irrigation project.

These people opted out of the project and were allocated fields elsewhere outside the blocks. Other people were recruited to fill in and cultivation commenced in 1989. By 1990 there were 11 females and 6 males registered as plottolders. At the time of the field work in 1994 this ratio had changed.

SCHEME DESIGN

Each of the 17 plottolders was allocated two hectares of irrigated fields: 0.5 ha for horticultural crops (garden) and 1.5 ha for the main crops (mainland). The majority of the farmers have no dryland plots besides those around the homesteads. Crops grown on the mainland are wheat in winter, maize and groundnuts in summer. In the garden section a variety of vegetables are grown, including rape, cabbage, tomatoes, okra, sweet potato, shallots, onion, late peas and baby corn.

The plots make up a rectangle, 920 metres long and 370 metres wide, of which some 220 by 370 metres form the garden section. Along the central axis of this rectangle are two buried pipes with hydrants at regular intervals rising to the surface. To these hydrants can be connected portable spray-lines with 18 sprinklers each. The water is pumped from the weir in Mundotwe stream to the scheme by means of an electrical pump and a main pipe some 200 metres long. The pump and pipes are designed such that five or six spray-lines are operated simultaneously. The scheme has six portable spray-lines at its disposal.

The lay-out of the scheme largely determines the cropping programme. Since the scheme is served by one pump, communal rotational irrigation is practised. It implies collective pipe shifting and sharing the one electricity bill. To minimise the hassle of splitting the electricity bill, it was decided (by Agritex) that farmers should grow the same crop on the mainland, that is, one variety, planted at the same time to ensure a uniform crop. A uniform crop will have the same water requirement, making irrigation scheduling easier. Members would then contribute an equal amount in cash towards the electricity bill. Such a design therefore results in the plottolders depending on

each other since they share the common resources and responsibilities of water, pump, laterals (pipes and sprinklers) and the electricity bill/

The pump and the electricity bill are recurring problems in Mundotwe, as we shall see. The pump sometimes breaks down, severely affecting production. The electricity bills are high. For example, in 1994 it was Z\$3500 per month from the end of May to end of October, when winter wheat and vegetables were irrigated. The electricity charges alone thus amount to some Z\$100 per month per hectare, which compares to a Z\$145 maintenance fee that irrigators pay in Agritex schemes per hectare per year. The electricity bill for the pump is paid from the seasonal crop loans given by Barclays Bank.

Since the scheme is the major water user of Mundotwe stream, the irrigators are the ones who regulate water flow. They open the gate in the dam some distance away, and the weir near the pumping station acts as a small reservoir.

THE IRRIGATORS

The original plottolders, as registered in 1989, ~~consisted of more women farmers than men. This was due to male urban migration, as one requirement to qualify for a plot was to be physically present most of the time.~~ Of the 11 original women plottolders, one was divorced from her husband, seven had husbands who worked away from home, whilst the remaining three women were married and lived with their spouses in the village. The present register of plottolders has changed, though most of the original households are still irrigating. Many of the absent husbands have retired or have withdrawn from town jobs since 1990. Upon return to the village, ~~they replaced their wives as registered plottolders.~~ Two members also dropped out because the work was too much for them. Presently there are 11 men and 6 women officially registered as plottolders.

• The 17 plottolders all belong to the Kanyowa kraal. The kraalhead is a Nyashanu. Members of the project are related. There are six members of the Nyashanu family, five of the Zunidza family, three members of the Kufa family and three others who are distantly related to the Zunidza.

The Zunidzas stand at the centre of these relationships. The five Zunidza members consist of two brothers, each with a son in the project, the fifth being a nephew (the son of their brother). Five of the six Nyashanus are brothers, the sixth being an uncle (their father's brother and also the headman of the sub-village). The mother of the five Nyashanu brothers is a sister to the two senior Zunidzas. This implies that the Zunidzas are uncles (*vanasekuru*) hence should be respected. The other cluster is that of the Kufa family, comprising a divorced lady with two daughters-in-law. The other three members are considered nephews (*vazukuru*) to the Zunidzas, though the relationship is distant.

FARMING STRATEGIES

These irrigators, though related and belonging to one kraal, are not homogenous. They differ in wealth, farming strategies and yields obtained. In terms of crop yields and general farming performance, farmers know among themselves who is the good or better farmer. Being a good farmer means attaining high yields, working diligently in one's plot, doing operations on time, being innovative and interested in one's work. The crop yields of wheat, for instance, reflect the differences among farmers (Table 2.1). Heterogeneity is even more marked in the garden section. Vegetables grown vary and depend on farmer preferences. This, however, poses problems for irrigation scheduling.

Table 2.1: Wheat yields on 1.5 ha plots (tonnes)

Plot no.	Gender plotholder (1994)	1990	1991	1993	1994	Average
1	male	6.7	6.1	5.4	2.8	5.2
2	male	5.9	5.6	4.0	2.5	4.5
3	male	5.9	5.9	4.5	2.2	4.6
4	female	n.a.	5.3	5.7	3.1	4.7
5	female	6.2	5.8	5.1	2.6	4.9
6	female	5.6	5.2	5.0	2.9	4.7
7	female	7.0	6.4	5.2	3.1	5.4
8	male	5.5	5.9	5.4	3.2	5.0
9	female	6.3	5.9	5.3	2.6	5.0
10	female	6.8	5.9	5.5	3.2	5.3
11	male	6.7	6.7	6.7	4.8	6.2
12	male	fallow	5.2	5.5	3.0	4.6
13	male	5.5	5.3	5.4	2.3	4.6
14	male	7.0	6.8	6.1	4.7	6.1
15	male	5.6	5.5	5.5	3.3	5.0
16	male	6.2	5.7	5.9	3.0	5.2
17	male	7.0	5.4	5.4	3.3	5.3
Average		6.3	5.8	5.4	3.1	5.1

Source: Matsika, 1995: 134

In order to appreciate farmers' priorities, it is worthwhile to look at their objectives regarding their irrigation venture. The objectives inform and shape the decisions farmers take and what they do, consciously or unconsciously. The farmers were asked to formulate their objectives with respect to irrigated agriculture. Some found it difficult to give a straightforward answer, yet there was consensus among Mundotwe irrigators about one basic objective: to improve their standard of living. But what this means differs from person to person. A relatively affluent 'good farmer' is the retired school head, who attains the highest yields and is always working in the plot. He, however, had all the farming implements and a brick under tile house before the project started. He gets a non-agriculture-based income from a pension, has a mature insurance policy, and remittances from children. It means having well-balanced meals, paying for regular medical check-ups and dressing well. For the poor 'good farmer' (never been to school hence never employed, no remittance from anywhere, major income is from farming, still has young children of school-going age) an improved standard of living means educating children, feeding and clothing them, building a decent home (brick under asbestos or metal sheets) and purchasing farming implements like scotch cart, cultivator, plough and planters. Women tended to value highly having a well and a toilet within the homestead.

* One important objective stated by most women farmers was to have regular cash to meet the day-to-day needs of the household. Hence they attached great value to growing vegetables such as rape, tomatoes and cabbages which they sold locally.

One major constraint that farmers face is shortage of labour. Farmers therefore prefer crops which are not labour intensive. This was expressed by the majority of farmers, especially those who cannot afford to engage casual workers. But those few with remittances from outside are willing to embark on any enterprise as long as it pays well. The permanent labour force available per plot ranges from 1 to 4, with 67 per cent of the households consisting of only two adults. Children always help out after school and on weekends. Because of the labour demanding nature of irrigation activities, irrigators have to mobilise labour outside the household for critical activities such as shelling of maize, weeding and lifting groundnuts, picking peas. They resort to labour hiring from the dryland farming sector. Payment can be in kind or on a cash basis (for example, picking peas Z\$5.00 per day, maize shelling Z\$7.00 per day). Money is scarce, though, such that irrigators rationalise as much as possible and eventually grow crops that are not too labour demanding. Groundnuts is one such crop, which though it pays well, is planted in small portions because of the high labour demand of weeding. For the same reason they are keen on wheat; the crop does not require much attention, although the yields attained are disappointing in some years and makes the crop less profitable. The labour input involved is on lifting or changing pipes since harvesting is done by a combine harvester. Consequently, it can be observed that farmers in the project seek to optimise and not necessarily maximise their resource use.

Besides these production objectives, social considerations play quite a significant role in decision-making about (irrigated) farming. The irrigators value highly their social relationships. Farmers thrive on producing well and being regarded as good farmers, which will boost their social standing. Even though women may sometimes harbour quite radical ideas, they tend to suppress their stance of, for instance, taking harsh actions against by-law breakers. They want to be regarded as good mothers, wives or relatives in the village. Thus the value attached to social relationships influences the way irrigators cooperate with each other in the scheme. In this context, the position of the chairperson of the irrigation management committee is especially delicate. He wishes to show to his fellow irrigators that he is a good manager. But this may sometimes imply taking decisions that might make him unpopular with some. On other occasions he is lenient, and by showing his human side he protects his image in the society. This means that socially informed decisions might affect technical decisions. These cannot therefore be separated.

MANAGING THE SCHEME: FORMAL AND FUNCTIONAL

Formal management

At the beginning of the project it was envisaged that project management would be the responsibility of two committees, one to be composed of external agents and the other composed of the irrigators. The external committee team comprised representatives from Agritex, Local Government and members of the finance company, and was chaired by the district administrator. The main responsibilities of this committee were planning, coordination and monitoring of project activities, ensuring that farmers and those providing funds met their commitments, and taking disciplinary action on those irrigators who failed to comply with the requirements as spelt out in the by-laws.

Within this main committee were sub-committees that dealt with issues pertaining to each organisation. The Local Government sub-committee was responsible for making available primary tillage equipment as and when required, maintaining discipline among the irrigators, and assisting, at cost, with the maintenance of the dam, weir, and pump.

The Agritex sub-committee comprised crop and farm management specialists in addition to the District staff team. Among the responsibilities of this sub-committee were preparing crop budgets, selecting the best crop combination for the farmers, preparing 'an operation' schedule, which included a cropping programme and irrigation schedule, and training of irrigators on crops and water management.

The farmers have their own separate committee, now known as the Irrigation Management Committee (IMC). The IMC is led by an elected chairperson, assisted by a secretary and a treasurer. There are sub-committees in charge of water management, discipline and security. The responsibilities of the main IMC and its sub-committees include:

- calling for meetings as and when necessary;
- ensuring that electricity bills are paid;
- liaising with suppliers of inputs and settling the related bills;
- collecting money for payment of land preparation operations;
- facilitating other activities, including farmers' training and entertainment of visitors.

The farmer management set-up was bureaucratic, lop-sided and reflected a top-down conception of irrigation development. More importantly it proved impractical, and was abandoned after the first year. The farmers simply took over from the second year onwards, and the IMC emerged as the actual organisation in charge. This change was unplanned, since at the time most irrigation schemes were government managed. One factor that must have contributed to this change was that Mundotwe, unlike most smallholder irrigation schemes in Zimbabwe, never had a locally based extension worker who acted as a full-time irrigation manager. The extension worker who served the area had other dryland farmers to cater for. Consequently, this irrigation scheme became farmer managed by circumstances and not by design.

Functional management

At the time of writing, the IMC is managing the project. It takes decisions, coordinates activities and is in charge of the scheme operation and maintenance. The management style is characterised by the calling of ad hoc meetings with all irrigators when there is a need to discuss issues or to address a pressing problem. These problems normally relate to either of two things: crops or the pump. The irrigators have managed to come this far without regularly calling for general meetings because there had been no need. Maybe all the formalities are not very necessary after all, since they have been managing without the external committee now for five years. Also, as current Agritex staff in the area are relatively new, the irrigators may be better versed in irrigation matters than the extension staff. The above should not convey a picture of an ineffective IMC: leadership positions have changed, and a one time secretary who misused project funds was sacked. The latter I consider a major feat, upon which I wish to elaborate.

I have already mentioned two important family groupings in the scheme: the Nyashanu and Zunidza. As the Zunidza are considered uncles to the Nyashanu, they should be respected. However, tensions have existed: although the Nyashanu are viewed as junior, they hold two key positions: one is kraalhead of the village, another is chairman of the scheme. The Zunidzas, in contrast, do not hold any politically important position in the village, and the vice-chairman and secretary, both of the Zunidza family, were voted out of the IMC during recent elections. It appears that this vote was mainly based on merit and did not cause many problems. Some Zunidzas voted against their relatives. This shows that Mundotwe irrigators have overcome a tricky trap common in many smallholder schemes. Their management style may not

conform to blue print models, but is effective and practical. For the irrigators, managing Mundotwe means getting themselves organised around two recurring themes: crops and irrigation. This I will elaborate in the following sections.

IRRIGATION SCHEDULING AND THE PUMP: COPING WITH A COMPLEX TECHNOLOGY

Because of the design, irrigation cannot be done on a plot by plot basis in the Mundotwe scheme. This then means that most irrigators should be present to shift spray-lines from one position to the next after a position has been watered. The pump operator informs the irrigators of the next pipe-changing time. People at times come late to do these operations and others are well known for not coming at all. If someone becomes very problematic they skip irrigating his or her plot. This does not happen very often, but has proved very effective, especially during winter. Pump operation is the responsibility of two members of the water management committee. These two see to the opening and closing of water gates at the dam, switching on and off the pump and informing the rest of the farmers when they are required to change the laterals. However, in case both operators are absent, any knowledgeable member of the scheme can take over the duties. Between them they split the duties such that one of them operates the pump during the day and the other at night.

The pump operator, in consultation with the IMC chairman and to some extent other irrigators, determines when to actually irrigate and for how many hours per point. As much as they might want to follow the recommended irrigation schedule (Table 2.2), prevailing conditions always dictate what actually happens (Tables 2.3 and 2.4). Such events are:

- pump breakdown, hence no irrigation; after repairs the pump operator may decide to water for fewer hours than recommended in order to quickly irrigate the entire scheme and minimise water stress;
- the schedule is also disrupted because of not changing pipes at night; they do not have torches and fear damaging crops; changing pipes at night is also not welcomed in the cold months of the year: June, July and August;
- when it is too windy irrigation is stopped since irrigators have noticed that water will be unevenly distributed and much is blown away by the wind and wasted;
- at times people are not available to change pipes, thereby delaying the schedule; one position will thus receive too much water, while the irrigation cycle will be delayed;
- on occasions irrigators may need to work in the garden section, for instance, for critical operations such as the picking of peas when harvesting is due; irrigation is then delayed because it cannot happen at the same time.

Table 2.2: Irrigation schedule as set in 1989

Date	Irrigated hours (per position)	Irrigation interval (days)
12–16 June	6	
19–25 June	6	7
26–30 June	6	7
1–8 July	6	6
9–16 July	7	8
17–23 July	7	8
24–30 July	7	7
31–6 August	8	7
7–12 August	9	7
13–20 August	9	6
21–27 August	10	8
29–3 September	10	8
4–10 September	10	6
11–17 September	10.5	7
18–24 September	10	7
25–30 September	10	7
1–8 October	9	6
9–15 October	8	8

Source: Agritex, Mundotwe project files

Table 2.3: Wheat irrigation schedule as practised (1990)

Cycle	Dates	Irrigated hours per position	Irrigation interval (days)
1	25–31 May	6	
2	1–3 June	6	6
3	15–19 June	8	12
4	1–5 July	8	16
5	14–20 July	8	13
6	27 July–2 August	10	13
7	5–11 August	10	9
8	16–22 August	10	11
9	30 August–5 September	10	14
10	11–17 September	10	12
11	27 September–3 October	8	10

Source: Matsika, 1995: 66

Table 2.4: Wheat irrigation schedule as practised (1994)

Cycle	Dates	Irrigated hours per position	Irrigation interval (days)	Remarks
1	26–29 May	6		
2	30 May–3 June	6	4	
3	3–7 July	6	34	Pump breakdown
4	8–18 July then 11–12 August	6	5	Pump broke down before completing cycle
5	13–18 August	6	35	
6	19–31 August	10	6	
7	6–15 September	10	18	Peas watering
8	22–30 September	10	16	No water in weir
9	7–? October	10	7	

Source: Matsika, 1995: 67

The operation of the pump and its maintenance are big issues in Mundotwe, as in other farmer-managed irrigation schemes. The 1994 winter season proved disastrous, because of one major pump breakdown in the middle of the wheat season (Table 2.4). The pump operators were not able to solve the problem. First, the District Development Fund (DDF) was approached. The DDF is favoured by farmers because they do not charge transport and labour costs. But the DDF's funds for this project had long been exhausted, and they could not help. Then, the irrigators had no choice but to call the commercial firm of Stewarts and Lloyds. Stewarts and Lloyds operates on a commercial basis charging transport to site, labour per hour and costs for replacement parts. The company charged about Z\$9,500.00 for the repair. As the irrigators did not have ready cash they had to take a loan (on top of their crop loans) at 32 per cent interest rate. The bill each irrigator had to pay represented a significant part of the net income they expected to get from their wheat crop. At the same time the wheat suffered from the water stress caused by the delays in repairing, and the yields were severely affected (Table 2.1). The farmers were, however, very eager to clear this debt quickly, since they were not sure when they would need Stewarts and Lloyds next. The company does not attend to the problems of indebted clients. In the end, the farmers arranged that each individual pay an agreed amount each time they got money from pea sales. The farmers further agreed that if some of their members were not able to contribute their part, it would be recovered from the wheat.

Although in principal the project is run on an 'each man for himself and God for us all' basis, this is not always possible as evidenced by the above scenario. The chairman, concerning this issue, said "*vamwe vedu tingavarasa here?*", meaning: there is nothing we can do with those who cannot pay for the pump repair. Those people are a part of us and cannot be abandoned.

The story of the pump breakdown indicates two major weaknesses of Mundotwe organisation: no irrigators were properly trained in pump mechanics at the start of the project, and the irrigators do not have a repair fund. At the same time, it shows the resilience of Mundotwe farmers. With difficulty they managed to get themselves on their feet again. The fact remains that the pump is a complex piece of technology to the irrigators, which draws them into dependency relations with outside actors: the unreliable DDF and the expensive Stewarts and Lloyds.

In sum, the training of some irrigators (or their offspring) in pump mechanics emerges as top priority. The establishment of a repair fund is a more contentious issue. The initial arrangement was that each irrigator would contribute a maintenance fee of Z\$150.00 annually. But some irrigators never paid their dues, and as no action was taken, the other irrigators also stopped paying. As the maintenance fund was empty, the pump has never been serviced since the project started. Farmers, then, appear to prefer paying up every time a problem surfaces rather than maintain a repair fund. Such a fund, of course, can easily be mismanaged.

MAINLAND AND VEGETABLE CROPS: MANAGING OUTSIDE ACTORS

It is not only the irrigation technology that forces Mundotwe irrigators into relationships with outside actors. ~~The crops they grow also drive them into sometimes complex deals with a variety of agencies.~~ There is Agritex, Local Government (DDF), Hortico-Produce (Private) Limited (hereafter Hortico), the Agricultural Finance Corporation (AFC), Barclays Bank, and the neighbouring commercial farmer, Mr Ramos, to name just a few. All these actors interact with the irrigators, and also amongst themselves, in issues involving the Mundotwe scheme. This section is organised in two parts: the crops grown on the mainland and those grown in the garden section of the scheme.

Mainland

Crop choice in the scheme is supposedly based on profitability as assessed by gross margin budgets and compatibility of the crops, including operations and rotations. On this basis, Agritex recommended a rotation of wheat in winter, and maize and groundnuts in summer for the mainland. Agritex is consulted for agronomy principles. For all the operations to be possible land has to be prepared, that is either deep ploughing, ripping or discing. This can be done by any one of three actors: DDF, the neighbouring commercial farmer (Mr Ramos) and a dryland farmer. Irrigators' choice is based on a number of issues.

DDF tractors, which can deep-plough, belong to government. They often breakdown and repair times are long. This is not suitable for the tight scheduling of crops in the scheme. Mr Ramos' fleet of tractors are also available for hire. The only set-back is that Mr Ramos, being a conservationist, is against deep ploughing, and will only disc or rip. As the irrigators are usually behind schedule for preparing the land for wheat, they cannot afford to wait for DDF's unreliable tractors and prefer Mr Ramos' fleet. An added advantage is that he allows them to pay after the work is done, unlike the DDF. The other option is to hire the tractor of a dryland farmer, but he charges more than double DDF rates. This avenue is usually used for preparing the garden section for summer cropping.

As for the transportation of the wheat crop, irrigators prefer to hire the trucks of Mr Ramos, and to move the wheat fast to the Grain Marketing Board (GMB) depot. This must be done quickly due to the threat of crop damage by rains. DDF trucks are cheaper and are usually used to ferry the maize harvest to the GMB, as this is usually done when there is plenty of time.

Mr Ramos, then, is indispensable to the irrigators for the wheat crop. Not only does he do timely land preparation and transportation of the wheat for them, he also harvests the crop with his combine harvester. The irrigators say it is impossible for them to harvest 1.5 ha manually with a sickle. The harvester cuts, threshes, winnows and bags the wheat all in one operation, on a plot by plot basis. Irrigators only have to sew up the bags ready for marketing. Mr Ramos is also appreciated as a great source of practical hands-on knowledge in wheat and groundnut production.

Garden section

Just as the mainland, the garden section is supposed to have a consistent cropping programme for each season; each plot being planted with vegetables of different types in rotation. The planned way of operation was that irrigators would plant the same crops on the same date, and apply equal amounts of fertilizer to achieve a uniform crop. However, since 1988, not all the garden section has been utilised. In summer, the greater part is planted with either maize or groundnuts depending on farmer, preference. In the 1992–93 season, a large part was put under Michigan beans. In 1993–94, 0.12 ha per irrigator was planted with fine bean — a Hortico project that failed. In the 1994 winter, 0.12 ha again was planted with mange tout peas; 0.08 ha had a variety of vegetables such as rape, tomatoes, shallots, cabbage and sweet potatoes, again depending on farmer's preference. In the 1994/95 summer, 0.12 ha of baby corn was planted in conjunction with Hortico.

Hortico is a horticultural company involved in growing, buying, contract growing and packaging horticultural produce, mainly for the export market. Crops usually encompassed in the project with smallholders include mange tout peas, fine bean, sweet corn and baby corn. The company buys from smallholder producers like Mundotwe farmers, and packs and organises transport for large-scale commercial

farmers. Although the company initiated the link, the venture is favourable to the farmers, who were not keen on 'large-scale' horticultural production due to transport hassles and unreliable prices at the market. Hortico linkages saw to more land in the garden section being utilised than before. In time farmers came to be in favour of this project since it provided inputs (seed, fertilizer and chemicals) on a soft loan, gave them a pre-planting guaranteed price, and produce was bought at the farm gate, hence there was no worry about transport and perishability of the produce. Land preparation was also done for them. Hortico personnel frequented the place and gave technical advice and were present to supervise spraying operations every week. Farmers were also in a better cash flow position since they got paid regularly, once every 2–3 weeks. Although relationships between Agritex and Hortico are not at their best, farmers are quite comfortable in dealing with Hortico on their own/

AN EMERGENT FARMERS' ORGANISATION?

The above data demonstrate that Mundotwe farmers can manage a smallholder scheme in their own right, from the beginning. This is not to say that they do not encounter problems in the process. Somehow, farmers manage to carry on and solve them themselves. The project is a learning process for them as well as for the agencies involved. Operation of the scheme also shows that even though irrigation is regarded as an alien technology in this part of the country, farmers manage to network, getting what they want from a number of agencies.

Farmers have incredible negotiating skills considering the number of actors they deal with in their operations. They know that if they have crop budgets they can get a loan from the bank. So they approach Agritex to draw up these budgets. If it is about tractors and transport and loans from the bank, they realise the need to maintain a good relationship with the District Administrator's office and the bank. They also maintain a business relationship with the commercial farmer, and have little problems in dealing with him. He is even prepared to help them. Hortico is a big company that is out to meet its export quota by getting the cheapest produce. Farmers are in a way gaining from this venture, though they know they are being 'conned' somewhere. At least they are getting their share of the deal.

That this is all possible is because the irrigators are an organised group. The group, through its IMC, gets things done. The group is fortunate in that they have a functional chairman who is keen on farming at a personal level. He and the other good farmers persevere even when things look gloomy. The chairman and his deputy, because of their enthusiasm in farming, set the pace for other irrigators, in terms of production. On the management side, the chairman has a lot of influence and is respected by other irrigators. This respect derives from his being the retired headmaster of a local school, but is further enhanced by the way he manages to minimise confrontations and conflicts among the irrigators. However, when necessary he is very abrupt,

enforcing the by-laws even if it means straining family relationships. He and the vice-chairman make the final decision. They consult other irrigators, but some ad hoc decisions such as when and for how long to irrigate are discussed between the two of them.

The community is so interwoven that it might not be very compatible with the operations expected in an irrigation project. For instance, one aim of the project is to be a profitable enterprise with a 200 per cent cropping intensity of crops that are financially viable. However, although a constitution is written to this effect, following and enforcing it is another thing. When a member produces below break-even levels, he or she is supposed to leave the project. This has not happened, because socially it is unheard of. The irrigators wait until a person voluntarily pulls out. Another example is when members were supposed to contribute towards an operation and maintenance fund but did not. The by-laws were not enforced as stated. They were giving each other another chance, to the extent that in the end everyone stopped paying. They only resumed when the pump broke down seriously, when it was a matter of life or death. Also men take over plowholdership from their wives, although against the latter's will. The IMC, being male headed, cannot be seen to reinstate the woman as this would raise a lot of (male) eye brows. Crucial decisions, then, are informed more by social norms than by technical criteria. Even when irrigators cannot pay up for certain funds, fellow irrigators are reluctant to act harshly. Yet, there are limits to the tolerance, as was shown by the fact that the secretary was finally voted out because he was a social nuisance. His production levels were well below expected, he misused the group's funds, he neglected his secretarial duties and was in constant conflict with the chairman. In the end everyone saw that he was not good enough to be the secretary. Consequently elections were held for the first time in 1994, and he lost his post. Mundotwe irrigators have made important steps towards an organisational structure that fits their needs, is compatible with the wider social environment, and appears relatively effective.

DISCUSSION

The first and foremost lesson that can be drawn from this is that farmers are knowledgeable and capable actors. (Long 1990). They succeed in adopting a new technology, adapt it to their needs, and ably manage the outside relationships which come with it.

Technology

Although irrigation is considered to be a new technology in the communal farmer's life, the farmers are managing well enough on their own. Dealing with all the many actors and irrigation infrastructure is not an easy task, especially when neither the farmers nor the extension workers had prior practical experience. The farmer who

has to do the job and produce for home consumption and sell the surplus, has to find his/her way around, using the scant and often impractical theories presented to him/her to get things going. The irrigators encounter a number of problems such as the complexity of having to operate the pump without prior training other than being shown how to switch it on. Through experience of working with the equipment on a day-to-day basis, they now have a rough idea where the problem is when the pump breaks. Also when sprinklers have a problem they know what to do. A similar observation can be made about the irrigation schedule. They have a chart that shows how many hours to irrigate when the crop is at what stage. In practice, this chart is not used. Farmers indeed have a rough idea about irrigation frequencies, but they have also learnt that prevailing circumstances dictate the course of action. When it is too windy they will not irrigate, even when supposed to do so: they know that a lot of their expensive pumped water will be lost to the atmosphere.

What then are the implications of these observations for sustainable irrigation development? The old irrigation policy, still in place, assumed irrigation to be such an alien technology that farmers would not be capable of managing schemes on their own. This perspective led to the establishment of Agritex-managed or ARDA settler schemes. In such projects the farmers were passive beneficiaries, since management was done by government officials. Agritex would be implementing cropping programmes, legislating, enforcing by-laws in the schemes and indirectly influencing the market by promoting government interests in certain crops. Agritex would further control water distribution through employing water bailiffs. Though farmers have a say in such schemes, overall decision-making powers have remained vested in Agritex. Operation and maintenance of the schemes was the government's business through Agritex. This was realised to be an expensive drain on the government's already stretched budget, since bills spiralled to well over Z\$2000 per ha per year. Some years ago it was modified to the effect that government would bear the establishment costs, pay operation and maintenance costs for the first two years and then handover to the farmers. Little is known how the newer schemes, now in their first years of independent operation, fare. It is in this context that the experiences of Mundotwe irrigators becomes relevant.

Policy implications

Ideas are emerging that suggest giving priority to farmer-managed and operated irrigation systems from the beginning. The government, as is usual, will assist in the development, whilst farmers are responsible for operation and maintenance of the irrigation system. Such systems, before their establishment, should have environmental, social, and economic impact assessments. The new stance in planning is to involve all actors in planning and development processes, such that the project will not be alien to the users but a thing of their own creation. Monitoring and evaluation should become critical in irrigation, since it is one way of assessing the

performance of existing schemes, and hence taking corrective measures when establishing new or rehabilitating old schemes.

After establishment, farmers are supposed to operate and maintain equipment and all infrastructure related to the project. All smallholder schemes operated by a group of individual irrigators share the infrastructure down to plot level. They have to coordinate irrigation schedules, as they may grow different crops. Input procurement and produce marketing may or may not be done collectively depending on farmer preferences. In such smallholder schemes, water users' associations are in the form of Irrigation Management Committees (IMCs). Their major functions are centred on communication and coordination of activities within the project. Functions also include decision making and planning through resource mobilization and management, and conflict management and coordination of activities, especially with regard to the operation and maintenance of the system.

The experience of the Mundotwe irrigation scheme demonstrates that it is worthwhile and important to stimulate farmers to become active beneficiaries, so that farmers feel that the scheme is theirs, and will thus take up the challenge and concomitant responsibilities.

Implications for agricultural extension

The change from viewing farmers as passive beneficiaries to active participants has implications for extension approaches. Extension workers need to modify their roles and approaches in order to cope with this new demand and to become more relevant to farmer emancipation. For this to happen it is important for the extension agent to know and understand his/her clientele's underlying objectives, and thus see the resulting extension needs. The Mundotwe case shows that farmers have as well as technical needs, social needs and objectives. Social objectives include maintaining good relationships with family and non-family members, being seen as good people by all, gaining and maintaining the 'good farmer' status within the project and society at large, gaining and maintaining a position of power, minimising or avoiding conflicts and confrontations, maintaining acceptable levels of labour input in collective and individual agricultural activities. The technical objectives are to attain optimum crop yields, earn a regular income and engage in less labour demanding manageable operations that correspond with the available labour force and financial viability of their enterprises. As can be seen, there is a relationship between social and technical objectives, technical objectives being dependent on or derived from social needs.

The extension service should be aware that irrigators need the following: *technically*, farmers require training in pump operation and crop agronomy, including scouting to identify pests; *socially*, they need practical cropping programmes, up-to-date marketing information and management and book-keeping skills.

The extension organisation has its own perspective on what farmer's objectives and extension needs are. However, from the extension worker's perspective, the

farmer's objectives are the same for all farmers; hence the dishing out of uniform book messages. As they are trained to be teachers and advisors, work is done this way. Consequently extension messages only partially address technical needs, leaving a gap. As a result of this deficiency, farmers are left hungry for more. Farmers want the extension worker to perform more than the teacher/advisor role, and to take up new roles such as facilitator, motivator, mediator, negotiator and liaison officer, amongst others. These other roles may address some of the technical and social needs and objectives felt by farmers.

The different perspectives of irrigators and extension workers also affect the way a project is evaluated. At Mundotwe, the farmers perceive the project as doing well, because they have improved their standard of living as reflected in what they have managed to acquire and achieve since the beginning of the project. These included the purchase of scotch carts and cattle, the building of good houses, the sinking of boreholes, the purchase of cultivators, ploughs and harrows, and their children's education. But according to the extension worker, the project's progress leaves a lot to be desired. His assessment may be based on maize and wheat yields below the projected yields. Also the fact that cropping intensity is below 200 per cent may be interpreted as the scheme performing below expectation. Yet the Mundotwe scheme demonstrates that it is an economically viable enterprise for its irrigators. Leaving aside the initial capital investment, farmers pay all running costs at, as we have seen, commercial rates.

Turning to irrigation development, the establishment of an irrigation project should cease to be just a way of commercialising and intensifying production. Irrigation development should include the farmers' needs, optimising both the social and technical objectives and needs. Farmers must be involved from project identification all the way through; not only be told that it is their project, but be given tangible responsibilities from the beginning of a project. Even though farmers face problems in management, government-managed projects are not without problems either. Government interference has caused many problems, since farmers have tended to regard projects as belonging to the Government. Giving farmers full responsibility for the project, as may be proposed by a new irrigation policy, may be a step in the right direction for sustainable smallholder irrigation development.



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