Water for Agriculture in Zimbabwe

Policy and Management Options for the Smallholder Sector

Edited by

mmanuel Manzungu, Aidan Senzanje and Pieter van der Zaag

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September 1998

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CHAPTER 7

Rethinking the concept of water distribution in smallholder irrigation

E. MANZUNGU

Reviewing the post-1970 burgeoning management literature on irrigation in developing countries during 1970–1985, Jurriens and de Jong (1989, 7–8) identified a number of problems. First, the literature, driven by a concern for the poor performance[1] of many irrigation projects, demonstrated different views on what irrigation was and its essential elements. Second, there was a wide variety of subjects and issues (including organizational forms and structures, farmers' participation, water users' associations, water distribution on main systems and at the tertiary unit level, water pricing etc) which were not systematically discussed. Third, there was too much of a 'software' approach (advocated by sociologists). This can be seen as a backlash against the engineering profession which had dominated the debate before the 1970s. This situation makes the case for rethinking the concept of management self-evident. But what might the elements of such a review be? In this chapter a reconceptualization is proposed on two fronts.

First, it is proposed that the role of technology in irrigation management needs a re-examination. One aspect needing attention is how technology is actually used in the irrigation schemes. This is relevant as technology is seldom used according to design specifications. People appropriate technology to suit their own purposes. How people appropriate technology and use it may inform the redesign of technologies to suit the requirements of users. Second, the definition of management should be a subject of discussion. In literature, management is depicted as the preserve of the 'managers', usually state officials. In this depiction farmers are the 'managed'. This is a paradox given that there are numerous examples of farmer-managed schemes. The concept of management is also cast into the roles and rules approach (Coward, 1985, Ostrom and Gardner, 1993) where the elucidation of these is considered important for effective management. This approach finds ready support in the goal and objective approach (e.g. Small and Svendsen, 1990) where irrigation systems are supposed to function according to set objectives. The problem with both approaches is that an *a priori* determination about which activities are done by which actors is not supported by the realities in many schemes. There is little merit, it is argued here, in investigating what happens in irrigation on preconceived notions. Instead what activities are done by whom must be a research topic. This is the approach taken in this chapter.

The issues raised are examined in the context of Chibuwe Irrigation Scheme. On the basis of how water was distributed between 1993 and 1996, this chapter hopes to make some observations about water distribution in particular and water management in general. The material points to water distribution being the domain of the water bailiff where he is the main but not the only player. Technical and social skills were important to make water distribution a reality. In this context, technical skills referred to the operation of technical infrastructure while social skills dealt with negotiations, ability and capacity regarding water distribution. The skills, however, were mostly self-taught in the light of largely inappropriate official management models. Important observations from the material are that, in the first instance, technology need not only be put at the centre of the irrigation discourse, but should include non-engineering aspects if fresh insights are to be obtained. This is because smallholder irrigation schemes involve more than the application of engineering principles. Moreover, management must be redefined to take account of the specific contexts of the schemes in question and, must of necessity, be preoccupied less with putting labels on what ideally must be done. This entails realizing that organograms when used as management frameworks constitute vertical attempts to impose management models that do not take account of the fact that management is done by a variety of actors on a 'horizontal' scale. Different actors stake out management domains for themselves.

These observations are preceded by (a) a brief conceptualization of water distribution, (b) a description of the study area and (c) a presentation of the empirical material. In the description of the scheme the focus is on how the technical infrastructure came about. The documentation of the history of the scheme is important since many of the issues in water distribution today date back to the early days of the scheme.

CONCEPTUALIZING WATER DISTRIBUTION

It has been observed that water distribution remains ill-defined despite its frequent usage (Nijman, 1993, 42–43). Where definitions are offered, e.g. Bos and Nugteren's (1983) 'movement of water through the tertiary and quartenary canals or pipe conduits to the field inlet', these are inadequate to give an idea of the real issues involved. Decrying this state of affairs, Nijman proposed the concept of allocation-regulation,[2] to strike a balance between technical and managerial aspects of water distribution, where allocation refers to the decisions about how much water is allocated, where and when, while (flow) regulation involves decisions on timing, frequency and size of gate settings along canals to get water to the offtakes (Nijman, 1993, 40). While the focus on managerial aspects is welcome, it is significant that Nijman's concept does not include the *how* and *why* questions of water distribution i.e. how water is actually distributed and why that is so, perhaps on the assumption that 'decision-making' automatically ushers in the desired water distribution. Besides, the concept places too much weight on the 'management', and assumes that farmers sit and wait for water to be allocated to them (Mollinga and Bolding, 1996, 11–12). Thirdly the contribution of ground staff, such as the water bailiff, is down played. This runs contrary to recent insights where actual water distribution has been documented to be carried out by ground staff rather than high ranking officials (see van der Zaag, 1992, Chapter 4).

For the purpose of this study the concept of water distribution suggested by van Halsema and Wester (1994) is used with some modifications. Water distribution can be understood as including people (farmers, state officials, and in some cases politicians) on the one side, and physical-technical dimensions (water availability and the technical infrastructure) on the other. People interact over how water is distributed as individuals and groups. These social arrangements about sharing water and irrigation facilities are not just social because, as already noted, physical and technical dimensions apply. As such, water distribution can be seen as having material and non-material dimensions. The material dimension relates to technical artefacts and water flowing in the system. Because of its visibility, this dimension has attracted the attention of technicians, particularly of engineers because measurements, figures and drawings can be ascribed to it. However, as will be shown later, the non material dimension relating to human interactions (social, political) are just as important, and in some cases even more. Besides, there is no clear-cut division between material and non material aspects of water distribution.

Specifically the focus in the chapter is on (a) the interactions between the actors (operating agency staff and water users) and (b) how the arrangements are mediated by physical and technical aspects concentrating on how the demands of the expected type of water distribution (delivery policy) structure the interactions.

An investigation informed by such a concept of water distribution, it is obvious, cannot be captured sufficiently by the technical method alone. This justifies a descriptive analysis of water distribution complemented by quantitative data that is adopted here.

In practice, water distribution can be studied by looking at how the delivery schedule[3] is *constructed* (referring to its origination), *constituted* (what elements make it up) and *managed* (how it is actually practised). A water delivery schedule includes the rate of flow or discharge that is made available to the farm turnout, the irrigation frequency or number of irrigation turns available over a certain period, and the irrigation delivery duration or the length of the irrigation turn (Clemmens, 1987).

THE STUDY AREA

Chibuwe Irrigation Scheme is located on the east bank of the Save River (from which the scheme draws its water) opposite its confluence with the Tugwe River, and lies 220 km south of Mutare (Figure 7.1). The scheme is 450 m above sea level and is located within Natural Region V. It is in Musikavanhu communal area which falls under the jurisdiction of Chief Musikavanhu.

It is claimed that the idea of the scheme 'started in June 1934 when at a Native Board meeting held by the Native Commissioner, Chipinga [now Chipinge], the people of Musikwantu Reserve made a request for irrigation'.[4] It appears, however, that E.D. Alvord[5] was the real driving force behind the scheme. He, however, looked elsewhere for the necessary justification:

> . . . it is most urgent that work on this irrigation project be started during [the] 1939 [financial year]. The situation on this Reserve is well known to you. That part of the Reserve located in the Sabi Valley contains large areas of some of the most fertile soils in the country, yet, due to low rainfall, this area is sparsely populated and only small lands which are situated along flood water channels are utilized. The natives tilling these flood water areas lead a precarious existence and, during the past season, they experienced an almost total crop failure. Yearly they suffer from a periodical food shortage and this year famine conditions exist to such an extent that authority has recently been given for the NC [Native Commissioner], Chipinga, to purchase 500 bags of maize for famine relief. It is at the special request of the NC, Chipinga that I now re-open this question.[6]

It appears that Alvord got enough support for the construction of the scheme but not for the type of irrigation to be installed. He was in favour of a gravity scheme for which he was ready to argue for, beg for, and when necessary, ridicule the rival pump option which was favoured by the Department of Irrigation.

Very early on Alvord canvassed support for his preferred irrigation type. He made it a point of visiting the area with the Acting Chief Irrigation Engineer, Mr P. Haviland, who, he claimed, was agreeable on the desirability of a gravity scheme.

But the Irrigation Department was not in favour of the gravity option;

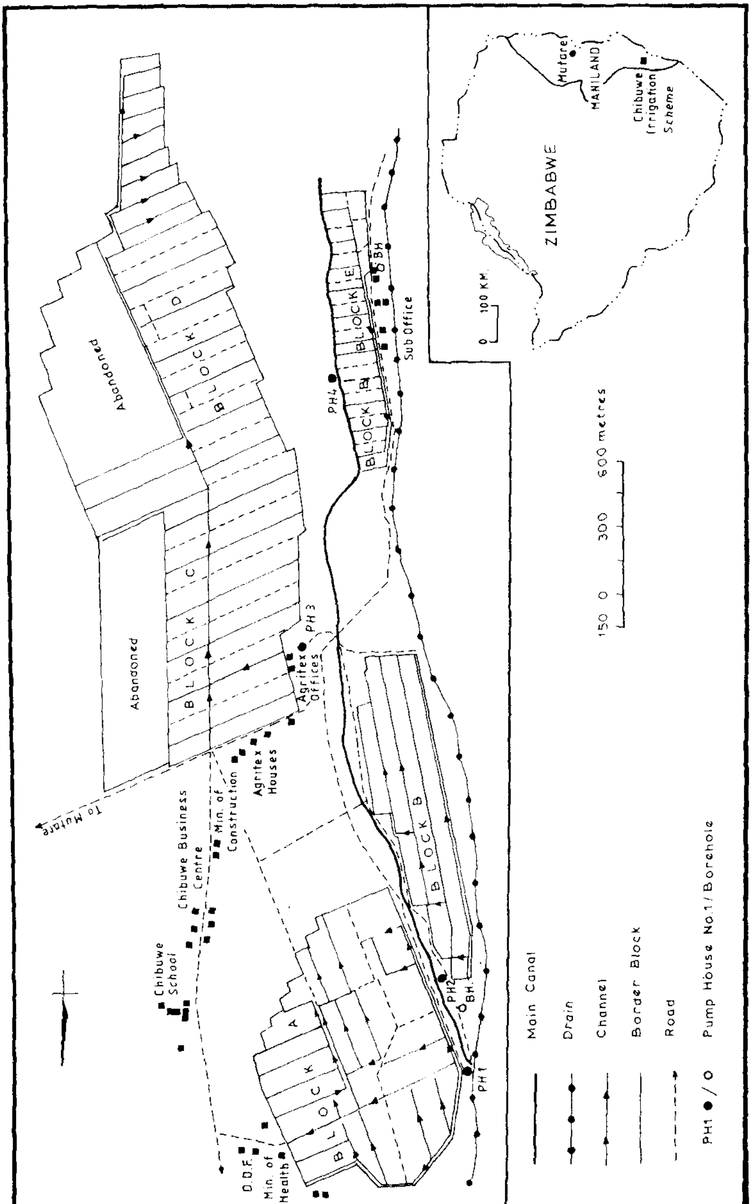
> In view of the fact that deep cutting in soft alluvial soil on the left bank of the Sabi River is considered dangerous on account of the possibilities of flood damage, a pumping scheme has been investigated to be operated by a steam plant as abundant wood fuel is available on the site.[7]

The pumping scheme was thought to be advantageous because;

a) the plant could be installed in a very short time as all equipment was available in the country; as such irrigation could be ready for the next winter crop,

b) the point of abstraction of water could be varied from time to time and different areas watered in rotation and

Figure 7.1: Chibuwe Irrigation Scheme: Location and sub-divisions



c) in the event of the gravity scheme being undertaken in the future, the proposed plant could easily be moved to another area.

Alvord objected strongly to the pump option, moreso because he had not been invited to the meeting that decided on the idea.

> It seems to me very extravagant and short sighted policy to spend the sum of £700 on the temporary installation of two pumping plants to irrigate 300 to 400 acres when for an equal amount or less a water furrow can be constructed which will command 2 000 acres. With reference to the imagined danger to the furrow by floods I am convinced that no such danger exists . . . The only thing I can see in favour of the pumping plants, is that they will make it possible to irrigate the area of very fertile lands, which are now being tilled by Natives in the vicinity of Chibuwe School, and which are already cleared of timber and stumps.[8]

Instead of spending more than £700 on pumps which were costly to maintain, in addition to the environmental problem of timber destruction, it was suggested that an area of fertile alluvium soil up to three miles wide and 12 miles long could be furrow-irrigated for less than £600 for labour and materials under the food for work programme.[9]

After the scheme was opened in 1940 the 200 acres that were planned to be pump-irrigated did not materialize 'due to the very open and porous condition of the soil it was not possible to irrigate more than 20 acres'.[10] The pump option proved to have a lot of problems thus strengthening his campaign for the gravity option. It was observed that the main stream of the river was near the West Bank making it difficult for water to be diverted to the pumps on the East Bank.[11] In that case it was only reasonable that the pumping plants be replaced by the 'proper gravity scheme as originally planned' since 'their [pumps] purpose as an experiment' was over.[12]

It appears, however, that the gravity option never really materialized as no gravity irrigation has been reported in the scheme. Table 7.1 summarizes the development of the scheme. Despite these problems the command area grew from 42 ha to 355 ha in 1958. In the 1950s, an ill-fated attempt was made to introduce sprinkler irrigation in one of the blocks. The block reverted to open-canal irrigation in 1958.

The present technical infrastructure

Chibuwe Irrigation Scheme, at present, consists of five hydraulic units/blocks (A–E). These blocks have open canals that bring water to the individual plots. All blocks are served by electric pumps which were first introduced some 20 years ago. Block A is serviced by two[14] pumps which have a combined capacity of 80 lps,[15] block B by one pump with a capacity of 45 lps, four pumps of a combined capacity of 130 lps service blocks C and D while block E is serviced by a 36 lps capacity pump.

Table 7.1: Some historical highlights of Chibuwe Irrigation Scheme

Year(s)	Event(s)
1940	E.C. Alvord starts the scheme
1950	The scheme has 42 ha under flood
1952 –1958	The scheme grows to 355 ha
1955	Block D opened up
1958	A new block 21.4 ha in size (now E) opened under sprinkler
1965	The new block (now E) is changed to flood
1968–1969	Block II (now B) redesigned and canals are concrete lined
1974	Electric pumps are introduced
1975	Block I (now A) is concrete lined
1975	Blocks III (now C) and IV (now D) are reduced in size because of poor soils

Source: Adapted from Sparrow (1983).[13]

The blocks have a differential water supply (Table 7.2) for a number of reasons. These are (a) the course of the Save River shifts to the western bank resulting in relatively poor water supply to all blocks, (b) silt accumulation in the diversion canal which disadvantages blocks B, C, D and E, (c) little water due to reduced flow in the river, (d) poor and variable physical condition of infrastructure and (e) frequent pump breakdowns.

Table 7.2 Chibuwe Irrigation Scheme: Size, number of farmers and rank of water supply (1 = best; 5 = worst)

Block	Size (ha)	No. of farmers	Rank of water supply
A	90	73	1
B	35	27	2
C	75	74	4
D	82	66	5
E	21	21	3

Source: Field data

Basically blocks A and B have a better water supply as they have concrete-lined canals while blocks C, D and E have mixtures of earth furrows, rectangular and semi-circular canals in a poor physical state. Block A is the uppermost and is the only block with pumps that draw water directly from the Save River. The rest of the blocks draw water from the diversion canal which is located 10 metres downstream of the block A intake. Along the diversion canal, block B pumping station is the uppermost, followed by block C and D and then block E. Although block E intake is located at the furthest part of the diversion canal, it is nevertheless on the main diversion canal, and has a better water supply compared to blocks C and D where water rotates between the two blocks. Block D can be considered to be at the tail of the tail-end as it is located beyond block

C. It has, as a consequence, the poorest water supply. Blocks A and D represent the most contrasting cases of differential water supply. Irrigation interval in block A is about 10–14 days while in block D it can go beyond 21 days. In the worst cases block D receives no water at all even in years that do not qualify as drought years.

Over the years, according to the Department of Water Resources, the pumps have received both major and minor repairs. Judging from complaints raised publicly and privately by farmers from blocks C and D, and the acknowledgement by the Department of Agricultural, Technical and Extension Services (Agritex) officials, pumps servicing blocks C and D have had more frequent and serious breakdowns. The unlined earth furrows for blocks C, D and E exacerbate the water supply situation because of seepage losses.[16]

Over the years the scheme has been issued with water rights of 253 lps from the Save River.[17] However, these water rights do not mean much in terms of improving water supply to the scheme.

Human resources

Agritex, under the Ministry of Agriculture, is the government department that manages the scheme as it does many other smallholder irrigation schemes in Zimbabwe. The Department of Water Resources, another government department in the Ministry of Lands and Water Resources, is responsible for the pumps in terms of operation and maintenance. The scheme had a government staff complement, as at the end of 1993, of the agricultural extension supervisor (hereafter the supervisor), three agricultural extension workers, one clerk, one builder, one foreman and a maintenance gang of 22 which, by 1996, had dwindled to nine. Farmers are represented in the management body by elected representatives. These include two representatives from each block. The block representatives make up the Irrigation Management Committee (hereafter the IMC or the Committee) from which are chosen the office bearers such as chairman, secretary and treasurer.

WATER DISTRIBUTION IN PRACTICE: THE DOMAIN OF THE WATER BAILIFF

Water distribution in block A

The water bailiff is a local of the area whose home is about three kilometres away from the block. He started work as a water bailiff in the block in December 1993. Prior to that he had done odd jobs e.g. in the early 1970s he was a migrant mine labourer in South Africa and later worked as a government-employed contract worker in the scheme. It is in this capacity that he participated in the construction of the present canals in the block. In 1982 he joined Agritex as a permanent general hand in the maintenance gang, a post he held until his appointment as water bailiff.

Three factors helped him to come to master his job rather quickly. First, he grew in the area and knew a lot of people in the scheme. Second, he was involved in the scheme before and consequently knew the general set up of the block and the infrastructure. Third, he gained some knowledge from a retired water bailiff. These experiences proved invaluable as he held one of the few Agritex jobs for which no training was available.

An overview of how irrigation is organised

After only about six months on the job, on 13 June 1994, the water bailiff showed that he was already conversant with how water distribution was organized in the block. This was evident from his explanations about irrigation organization in 'his' block.

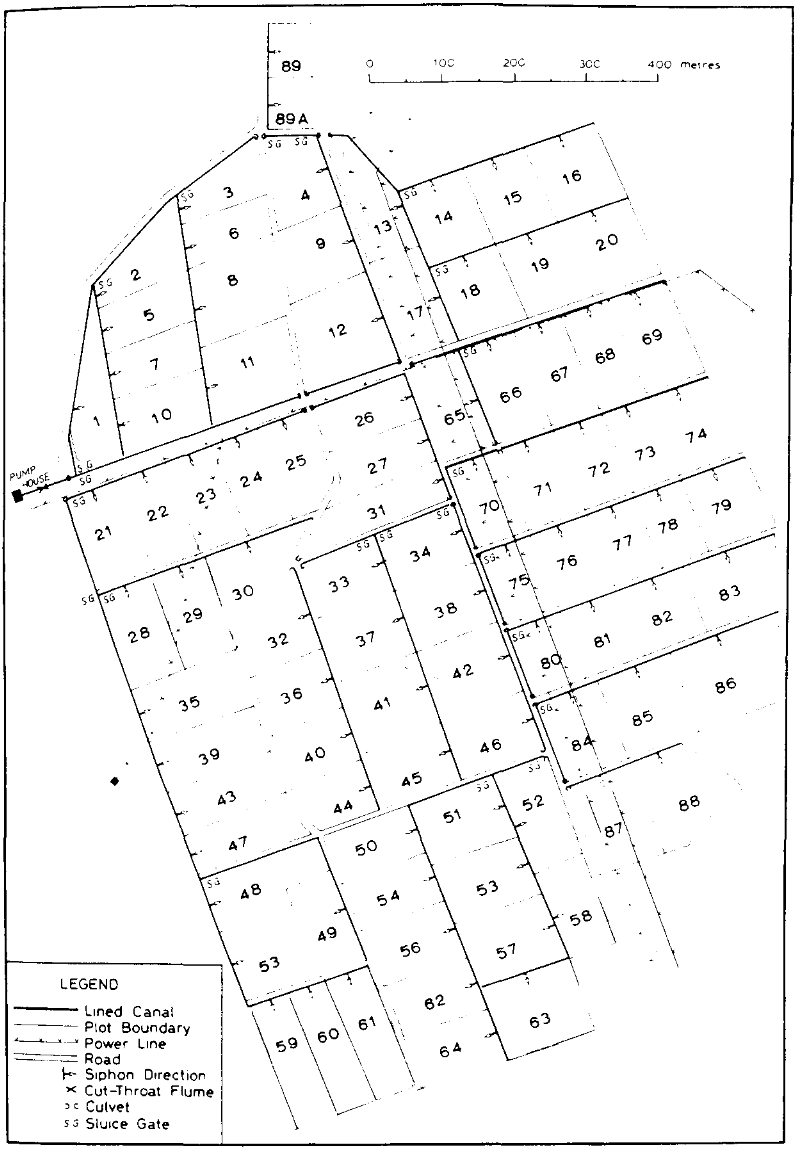
In 'his' block water is channelled via trapezoidal canals that are in good physical condition. He distributes water to 90 ha of land demarcated into 88 plots and farmed by 70 farmers (Figure 7.2). As can be seen from Figure 7.2, the block has a very short main canal which branches into three canals codenamed (by the researcher) northern canal for the most northern, central for the one in between and the third as the southern. Irrigation is organized according to the 11 "blocks".[18] Figure 7.3 shows the location of the various "blocks" within the block.

The "blocks" derive their names from the names of farmers who take the first irrigation turn e.g. if farmer Taruziva takes the first turn then that "block" is known as Taruziva's "block" (see Table 7.2).

All the "blocks", with their respective members, the plot number and plot size area, are written in a book which he keeps at his home. He does not need to carry the book because he knows the information by heart.

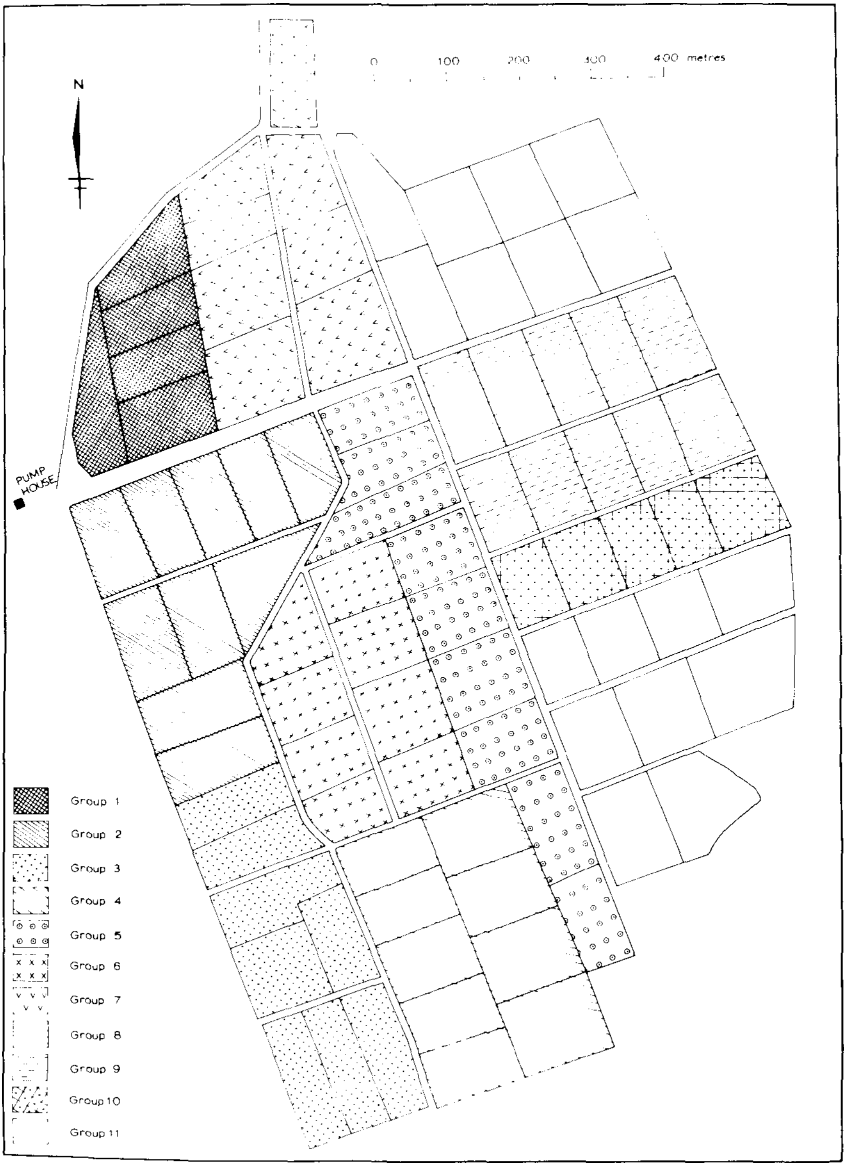
In each "block" farmers take turns to irrigate i.e. per "block" one farmer irrigates before water goes to the next farmer. Usually at any one time there are 11 farmers irrigating, one from each "block". When water is in short supply the number of irrigation groups is reduced to eight or any other appropriate number. Irrigation is mostly from Monday to Saturday. Sunday is used to catch up on delayed irrigation schedules. On Tuesdays and Saturdays irrigation is organized differently. These are the 'garden days' set apart by the Irrigation Management Committee to let farmers irrigate their vegetables. Vegetables, it was reasoned, needed shorter irrigation intervals. On these days normal irrigation duties only start after 12 noon by which time gardeners are supposed to have finished irrigating. In most cases irrigation is during the day from 6.00 am to 4. 30 pm in summer and 6.30–7 am to 4.00–4.30 pm in winter. Irrigation may also start at 5.30 am. This depends on the water bailiff. Even night irrigation is also arranged.[19]

Figure 7.2: Map of block A



Source: Based on field notes

Figure 7.3: Irrigation groups in block A



Source: Based on field notes

Table 7.3. Details of irrigation "blocks" in block A

Name	No. of farmers	Total area (ha)	Plot number
[1]Tazira	6	10.3	35 & 39
[2]Nyamadzawo	5	4.8	—
[3]Tinonetsana	9	8.8	11
Albert Nkomo	8	8.3	13
[4]Hlahla	8	10.7	65
Janson Mapindu	6	7	75
Fumani	6	7.5	81
Hilda Chibuwe	7	9	—
Benhelda Makuyana	6	7.5	33
Kefas Chibuwe	7	8	43
[5]Total	68	81.9	43

[1]This particular group requires water continuously which is difficult to honour in practice hence is short of water for most of the times.
[2]This group has a very comfortable rotation. The water bailiff in 1994 wanted to add another farmer to this rotation. Here 5 siphons are used instead of 10 because (a) water flows are swift since farmers draw water from one of three secondary canals and also because (b) the block is located near the main bifurcation point.
[3]This group requires water every time because the water does not move as fast due to the fact that the land is not well levelled. The water bailiff planned to shift one person from here.
[4]This "block" has continuous irrigation.
[5]The total area does not come up to 90 ha because the plots were originally mapped out in acres and the local conversion is 1 acre = 0.4 ha.

Source: Field notes

When the water bailiff was elaborating on the "blocks" on 13 July 1994, it was clear that he had intimate knowledge of the "blocks". He could point to the various "blocks" and tell the irrigation sequences that were followed. He had also information about the farmers themselves. He could, for example, mention the name of the "block" and the names of the farmers in that "block". This he did without referring to a map. An invitation to indicate the plots on a map produced the reply that "your map is confusing me."

In addition he was knowledgeable about details such as the plot number, the registered name of the plotholder and who was currently cultivating there. He also knew whether the plots were registered in the name of a female, belonged to a widow or to a woman whose husband was present or away in paid employment somewhere. This knowledge was complemented by observations about how farmers irrigated. At times it was necessary for him to threaten to take the water away when water was being wasted, especially when children[20] were involved.

When a farmer receives a turn, he/she irrigates his/her plot until he/she finishes after which water passes to the next farmer. If a farmer holds onto water for too long the next farmer negotiates with him. Changing of water from one farmer to the next, without his involvement, happens quite often as farmers are aware of their "blocks" and the irrigation sequence. As a matter of fact he makes no fuss about being physically present at change-over time. In cases of disagreements he plays a mediating role.

His intimate knowledge about the conditions in farmers' fields translated into different duration of water supply from "block" to "block" and farmer to farmer i.e. water was not rotated simply on time basis e.g. six hours. Difficult "blocks" and fields were given more time (see Table 7.3). But in peak water requirements e.g. at planting, the approach changed. The time limits became more strictly observed with the aim of giving each farmer "a chance" to irrigate.

Operation of the technical infrastructure

The pumps

From day to day the water bailiff not only deals with people but with the technical infrastructure. He has to coordinate pump operation as well as the opening of the head-gate[21] and other gates so that the 'right' quantity of water gets to the irrigators.

With regards to pump operation, he liaises with an experienced pump operator of the Ministry of Lands and Water Resources who has been on the job for 20 years. The fact that the pump operator is from a different ministry does not pose major problems. The understanding is that the water bailiff, at the end of the day, assesses how many farmers are due to irrigate the next day. He then informs the pump operator on the number of pumps to be operated (which is a choice of two since only two pumps are involved).

Because the pumps are in general reliable, both the water bailiff and the pump operator can afford to take illegal[22] breaks from the block. Sometimes the pump operator does not receive instructions on how many pumps to operate because the water bailiff may not be there. This is quite common. In such cases the pump operator simply operates the two pumps and in most cases this works out, especially during the peak periods. There are, however, cases where fewer-than-expected farmers turn and then water goes to waste. There is also another problem. When pumps have to be closed unexpectedly,[23] the presence of the water bailiff to notify farmers is important otherwise farmers blame the pump operator for closing the pumps for no good reason.[24]

There are times, however, when the water bailiff initiates pump closure. This is when fewer than expected farmers turn up. Such situations of pumps having to be operated and then closed down tend to happen at non-peak times. This is because farmers do not put up requests for water but come for predetermined rotations. As a result, the water bailiff may not get the number of farmers due to irrigate the next day. The other problem is that the pumps are single capacity.

It is difficult for the water bailiff to be able to precisely determine whether one or two pumps should be operated in line with the number of farmers irrigating.

The gates

After pump operation the next task is to allocate the flow to the various farmers due to irrigate on the day. The starting point is at the main bifurcation point where there is the head-gate fitted with two sluice or undershot gates. So how does the water bailiff perform this hydraulically challenging task?

He explained that he used the rule of one notch on the gate, to let out a flow that is sufficient for one farmer. This was not entirely true though as was illustrated during one demonstration. On the southern canal he used two notches per two farmers (one notch one farmer) while on the northern canal he used seven notches per three farmers (2.3 notches per one farmer).

"But you told me that one notch was one farmer?."

"Yes, but on this gate I use 7 notches for 3 farmers."

"Why?"

He shrugged his shoulders and explained that this canal was higher than the other canal. It might not have been the best of hydraulic explanations[25] but he had made his point. Table 7.4 shows the discharge measurements at the main bifurcation point over a period of five days. It can be seen that the central canal transmits the swiftest flows and also irrigates the largest portion of the block. The discharge, it can be noticed, is quite uniform which is quite remarkable as this was based on technical training.

Table 7.4: Discharge measurements at the bifurcation point in block A (Figures in parenthesis are flow percentages)

Day	Total flow (lps)	Northern Canal (lps)	Central Canal (lps)	Southern Canal (lps)
1	143 (100)	45 (31)	98 (69)	0 (0)
2	146 (100)	40 (27)	76 (52)	30 (21)
3	155 (100)	38 (25)	85 (55)	32 (20)
4	144 (100)	43 (30)	73 (51)	28 (19)
5	140 (100)	38 (27)	72 (51)	30 (22)
Average	146 (100)	41 (28)	81 (56)	30 (16)

Source: Adapted from Mataranyika (1995)

Gate operation does not always start at the main bifurcation point. As his home lies opposite the intake he sometimes adjusts the gates at the farmers' fields from the southern portion of the block first and works his way upwards. This is in order to contain water losses as he usually comes into the block 20 to 40 minutes after pumps have been started. His coming later in the block is in order to find the canals full of water rather than wait for them to fill up. For the whole system to stabilise, that is until there is, according to him, negligible water wastage at the end of the canals or through overtopping, takes him forty minutes to one hour. Once the system is stable he moves around the block checking for water thefts. Around 10 am he gets on his bicycle to go home for tea; for 60–70 per cent of the time he does not come back to the block until the following day. If he comes back it is around 4 pm. He will then make the final round in the block and go on to talk to the pump operator who by then is on site ready for closing down the pumps.

Each farmer in principle knows how the gate before his field is operated. In many instances the one notch one farmer principle applies. In general however, farmers also adjust gates clandestinely to let out more water when they feel like it. Despite this the one farmer one notch principle remains important as it allows farmers to police each other.

Generally the gate adjustment by the water bailiff results in minimal flow variations (Table 7.5). The discharge measurements of 30 farmers on different canal sections illustrate this adequately. This again is a remarkable achievement as no technical measurements were used.

Table 7.5: Flow rates (lps) to 30 individual farmers

Farmer	Northern Canal	Central Canal	Southern Canal
1	12.1	10.9	13.3
2	9.0	18.2	15.9
3	16.1	12.1	10.1
4	6.0	19.7	18.0
5	12.8	11.6	15.8
6	9.9	15.5	12.5
7	16.8	15.4	12.6
8	11.4	15.9	14.7
9	9.8	13.4	12.8
10	18.6	20.0	14.2
Average	12.25	15.27	13.99

Source: Adapted from Mataranyika (1995)

Social aspects of water distribution

There are other duties that the water bailiff performs apart from distributing water. One of these is dispute settling between farmers. Farmers attach great importance to the dispute settling role of the water bailiff. Many 'weak' farmers find him a real help as this incident shows.

Saturday 16 July 1994 was, as usual, reserved for irrigating vegetables. Many farmers, particularly women and children, came out in large numbers. Children were many because it was a Saturday, as also happens during school holidays. In Chiwororo's field (plot 17) were his two male workers waiting for water as the pumps had just been operated. They wanted to irrigate beans which they had not finished irrigating from the previous day. How would they do that since this time was reserved for irrigating vegetables?

They were vague about it while complaining that "these people with gardens were a problem because they delay finishing irrigating" which kept them in the fields "all day long". As the water was approaching they got ready to irrigate. A row erupted between them and a woman who wanted to irrigate her vegetables. The woman reminded them that it was the vegetable day. The two workers insisted that they were going to use the water all the same. As the altercation continued the woman became less and less confident as she realised that she was physically powerless to do anything; "you may do that but it is against the law."

A second woman, who also wanted to irrigate her vegetables from the same canal, joined on the side of the first woman. Again Chiwororo's workers did not have much of an argument but insisted they were going to irrigate anyway. Another woman who was irrigating in a nearby field overheard the altercation and came over to try and resolve the matter. The third woman delivered her verdict; it was the day for irrigating vegetables and Chiwororo's workers had to surrender the water (they were now irrigating). As for the second woman she had no right to the water from that canal since she did not normally use it for her irrigation. In spite of that concise judgement, Chiwororo workers continued to irrigate.

Soon afterwards the water bailiff appeared. The women wasted no time in reporting the matter. The water bailiff calmly told the Chiwororo workers to "respect the law". They complied.

The water bailiff also deals with water thefts. Water theft falls into two categories. If a farmer tampers with gates and increases water to their plot and no other farmer is seriously affected, and there is no complaint, this goes unpunished. Besides it is difficult to pinpoint the culprit. In such cases the water bailiff merely adjusts the gates and leaves it at that. There is, however, a serious water theft that attracts a fine. If a farmer irrigates when it is not his/her turn that is a punishable offence. Such cases tend to be on the higher side particulary at peak demand times.

For all his efforts, the water bailiff is paid Z$600 per month. It is a meagre salary in relation to the amount of work. But he is better off than most people in an area where living off the land, especially in Natural Region V, where only two out of every five agricultural seasons are good, is extremely difficult. Besides, he has only four years of primary education which does not put him in a position to get a good job.

Coping with difficult times

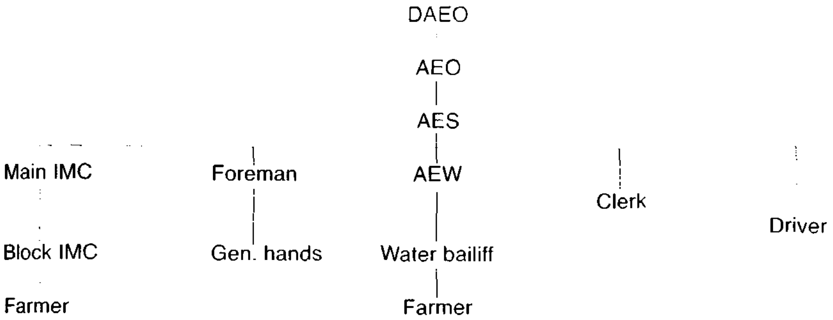
The above paragraphs have set what can be called the water bailiff 's routine when he is 'in control'. But there are times when things are difficult for him. Between 1994 and 1995 there were three such incidents. The first one was when flow measurements were initiated on 24 August 1994. He was visibly worried as he thought that these would be used against him. That whole day he was in the block making sure that as little water as possible was going to waste. He threatened some farmers that if he was arrested because of water wastage, he would also make sure that they were also arrested! After receiving assurance that nothing of the kind would happen, he reverted to his routine. The same thing happened on February 1995 when there were University of Zimbabwe students taking measurements.

Another time when he was very worried was when the supervisor was closely monitoring all the water bailiffs. Apparently this was because the supervisor came to the block but did not find him. He had also gone to the other blocks to find the same situation. Consequently, he summoned all the water bailiffs and admonished them. Now, he said, what he heard from the IMC that water bailiffs did not work was true. The water bailiffs responded by saying that they had other duties to perform like announcing field days, collecting money for shows; some of their work fell outside the block. The supervisor was not convinced so he made each water bailiff to write down exactly what he did everyday.[26] The water bailiff also produced his list (Appendix I).

The supervisor later admitted privately that the water bailiffs were too busy. This was after he had produced the position charter for the water bailiff (Appendix II) on the basis of the submissions of all the water bailiffs. He said that the day of the water bailiff was actually too packed such that he could not fit his duties in the official eight-hour day. So it was a happy ending for the water bailiff after he had been forced to be in the block for most of the day where he used to complain bitterly about "this thing that does not work".

All the same the supervisor insisted that he was in charge of all management aspects including water distribution. He constantly uses the organogram (Figure 7.4) as his reference point. However, water distribution was clearly not his domain as illustrated by the following incident. During one morning he had insisted to the researcher that the IMC was below him otherwise how could he "implement water scheduling"? An hour later he was surprised to discover that the pumps in block A were not operating. Who had ordered that without his consent? The author told him that the water bailiff had done so because there were no farmers willing to irrigate as the day was cloudy. He did not try and reverse such a pragmatic decision.

Figure. 7. 4. A Depiction of Management set up in Chibuwe



DAEO District Agricultural Extension Officer
AEO Agricultural Extension Officer
AES Agricultural Extension Supervisor
AEE Agricultural Extension Worker
IMC Irrigation Management Committee

Source: Supervisor's diagram presented at Agritex training workshop at Manesa, 5–9 September 1995.

A comparison with block D

The water bailiff in block D has been in post since 1976. Before working in block D he used to work in block C and E. Just like the block A water bailiff, he displays a lot of knowledge about who farms in which plot, the marital status of the plotholders and the various irrigation groups. However his way of operation is different in that he hardly comes into the block. The reasons have mostly to do with the poor technical infrastructure as well as the poor water supply.

Basically he attracts criticism from virtually all quarters for "coming late and leaving early". This means he comes to the block around 9 am and about an hour later goes away. It is said he goes away to drink beer. This is the view of the supervisor and farmers.

When he comes into the block he moves around sometimes (at other times he just passes through some fields) adjusting gates which farmers would have already adjusted in the early morning when they turned up to irrigate. This gate adjustment was a symbolic stint more than anything else because (a) the adjustment is quite familiar to farmers and their adjustment is just as effective, (b) the gates themselves are of poor physical condition and of different shapes and sizes (sometimes in the same stretch of canal) making the usefulness of the gate operation doubtful and (c) the system is so open to variation (because of leaking gates, seepage into earth furrows and upstream users). It normally takes water three hours to reach the block.

Summary

Water distribution in block A is clearly the domain of the water bailiff where he is the main but not the only player. In this enterprise the bailiff contended with two main factors; the people and the technical infrastructure.

With regards to people the water bailiff took account of other actors such as the supervisor, the pump operator and the Irrigation Management Committee. This demanded a lot of negotiating skills to reconcile the sometimes conflicting interests of the actors. One important strategy he used was to personalise water distribution. It was necessary, for example, to view the block; not just as a physical entity, but as 'his' block, his own possession to which he was personally attached. Similarly the "blocks", which represented the various irrigation groups, were not known by such impersonal names as group 1 or A but as Taruziva 's block. Even the way he dealt with farmers showed that he did not blindly invoke rules. He balanced them against the situation. That was why stealing water was not always punishable.

Similarly, rather than use impersonal times e.g. six hours, he allowed, within reasonable limits, farmers more time trusting their judgement on the duration of the irrigation turn. But this was just not a social device; it was an admission that the physical condition of the fields could be different such that a defined irrigation turn would not correspond to the specific field.

He also needed technical skills to deal with the technical infrastructure which were not offered by Agritex or Department of Water Development. Instead they were acquired through constant observation as well as from farmers who had been in the block longer. Further, the technical knowledge was shown in using a lower number of siphons where the flow was faster, implicit appreciation of the gate (free flow or submerged) conditions as well as recognising that the infrastructure would always leak no matter how hard he tried. As such his being in the block always was not useful, he reasoned. His turning up 'late' to the block was to allow the canals to fill up, the timing of which was dependent on observations. His stabilising of the infrastructure was not a taught thing — it was again gained through experience. This shows that the water bailiff had internalised infrastructure (van der Zaag, 1992, Chapter 4). As a result he knew the limitations of the system. Similarly, block D water bailiff knew that it was impossible to internalise a system with the capricious water flows. But rather than do nothing, which could cost him his job, he did something to legitimise his job.

DISCUSSION

It has been shown that management cannot be described in 'software' terms, i.e. people 's interactions or in the 'hardware' in terms of canals, pumps etc.

This is because any management activity involves people employing some form of technology which could relate to artefacts, skills and knowledge or organizational aspects. Two salient points about irrigation management can be made from this. First, technology in its wider sense (see Croxton and Appleton, 1995) is an integral part of management. Second, various actors, including institutions, are active in management activities. This underlines the fact that actual management does not follow official organograms or roles and rules (Coward, 1985; Ostrom and Gardner, 1993) that are predetermined. These two observations become more self-evident if the material presented here is summarised.

It was demonstrated that people who are normally considered non technical, such as the water bailiff and farmers, were very active in the technical realm. However, this was not according to explicit engineering or expert knowledge. We saw that without any prior knowledge of hydraulics, and without any training offered, the water bailiff and farmers developed a workable system. This was obviously through painstaking observations that included trial and error. The operation of the sluice gate is a case in point.

Since the artefact was used by more than one person some social arrangements meant to achieve equity had to be made so that there would be some harmony concerning its use. Thus the fact that the one notch one farmer rule was used at the gates near farmers' fields was a combination of social and technical considerations. Farmers knew that this was not a 'water tight' technical arrangement. Rather than challenge its technical basis, farmers decided to use it because if they refuted its validity, then there was little else around which social arrangements could be made. This underlines the fact that 'non-technical' people have a technical capacity that includes the ability to locate the technology within the immediate social context (Croxton and Appleton, 1995). The situation could be much better, it is argued, if structures such as proportional divisors were in place which farmers could easily identify with.

A related observation is that the block A water bailiff has over the years come to have a 'feel' of the hydraulic system or has internalized the system (van der Zaag, 1992). As we have seen, without the benefit of formal technical knowledge or sophisticated measuring equipment, he equitably distributed among farmers as evidenced by the fact that farmers did not in the main quarrel with him. In this exercise, farmers also played a part as they identified with the system with all its weaknesses, which ironically made the system flexible. The water bailiff knew the physical limitations of the system. For example, he knew that there was no point of remaining in the scheme as little could be achieved. No increased efficiency could be obtained by simply being there in the block. This differed with the supervisor who, without an understanding of the physical system, wanted the water bailiffs to spend most of their time in the blocks. The supervisor also believed that proper management was when the roles as per the organogram were respected and rules were diligently applied as amply illustrated in Appendix II. Because of his superior position the supervisor sometimes shaped the practice of water distribution if only by way of 'casting his shadow' from time to time on the water bailiff, who had no option at times but to implement (or pretend to) the rules some of which he knew were impossible to apply. For example, he could not gauge the water level because it was not clear what was being referred to. The water bailiff in block D also showed the same aptitude for the system — it was useless to try and do the impossible. At the same time one had to be seen to be doing something. What else but play the symbolic by adjusting gates? The challenge was how not to jeopardize his job and at the same time maintain social relations with farmers on the basis of effective water distribution.

The technology debate referred to here can also be linked to practical and policy issues. For example, how does the technology in place promote better irrigation efficiencies in a smallholder irrigation setting? It is known that sluice gates cause more downstream flow fluctuations (Plusquellec *et al.*, 1994) which has important implications for downstream farmers. As a result farmers could end up 'stealing' water with the accompanying inefficiencies due to reactive over-irrigation and concomitant shortages in some sections, which is a consequence of the type of technology rather than the behaviour of farmers. The other point has to do with the issue of whether technologies can facilitate volumetric pricing of water at and within the scheme, which the current water reforms in the country (IAP-WASAD, 1993) seem to suggest. This can also be linked to the administration of water rights. The requirement of the installation of such gadgets as V-notches means very little to smallholder farmers who do not identify with the legislation governing the use of water (see van der Zaag and Roling, 1996).

While the technology is important in the operationalization of some policy issues, it is equally important to avoid the technical fix syndrome. Institutional issues are important. There must be in place suitable institutions through which communication between farmers and the implementing agencies can happen. Fundamentally it means that the role of Agritex has to change. It is important therefore to link up organizational or institutional issues with technology, because in irrigation, technology is a fact of life.

The last discussion point must be about the general concept of management. It was mentioned that there has been an upsurge of goal and task oriented approaches to irrigation management. These approaches, it was demonstrated here, are severely limited because of an *a priori* determination of what should be done by who and how. From the empirical material provided it is obvious that little insight could have been obtained by the application of goal and task oriented approaches for two reasons. The assumed knowledge that those in authority should have was non-existent and as such they could not instruct their juniors on the specifics of water distribution. Instead, the technical capacity of the water bailiff and farmers was remarkable. Secondly, what happens at the scheme level is also subject to many extra-local influences. An unclear policy framework, and an unfavourable hydrologic environment, combined to make the situation changeable, which rendered the formulation of objectives difficult. As has been shown above, the 'management' itself was not involved in water distribution but the 'managed'. Clearly the water bailiff and the farmers were managers in their own right. There is therefore a need to reconceptualize management. This might begin by realizing that management is more horizontal than it is vertical i.e. it is useful to think of different people being involved in different aspects of management rather than think that there are 'managers' at the top who issue instructions to the 'managed' as the organograms imply. The emergent nature of the management domains (see der Zaag, 1992, chapter 9) where different actors are active should be appreciated. A historical precedent already exists; indigenous irrigation systems in East Africa have been shown to operate in tune with social structures (e.g. Fleuret, 1985), a management set-up that is non-bureaucratic which is in sharp contrast to public-managed schemes whose bureaucratic management set-up often clashes with farmers' concept of organization.

CONCLUSION

Technology should be at the centre of the irrigation management debate. As the chapter has shown, many irrigation activities involve one aspect of technology or another. One point that came out clearly was that real-life situation management in smallholder irrigation is more horizontal than it is vertical i.e. different management activities are done by different people. This is contrary to the popularized meaning of management where 'managers' give out orders to be performed and the 'managed' comply. A pertinent observation is that these management domains are usually not planned for but emerge as a result of negotiations between the various actors. A practical implication is that those that write policies must not produce blueprints about how and what roles are done by whom without a thorough appraisal of the situation on the ground. While guidelines are important, the actual management complexion is the result of local actors and factors.

There is also a methodological point. The case of the sluice gate operation has demonstrated that verbalisation of people's skills and knowledge is not always possible. This means that surveys (and even informal interviews) may not adequately come to grips with the reality as it is. In such cases participant observation is the answer. There is therefore room for both quantitative and qualitative methods in irrigation management research.

NOTES

1. Performance in irrigation is a problematic subject for two main reasons. Firstly, it has been said that there is no common quantitative measures of performance. Even if there were common measures, as suggested by Small and Svendsen (1990), one can express doubt over the value of such normative standards in diverse situations.
2. Nijman rejects Cornell-based allocation-distribution paradigm on the basis that this omits the issue of flow regulation.
3. Basically the method of water delivery can either be *on demand* or supply-oriented. In *on demand* systems farmers take water whenever they want it. This applies in those situations where water is not limiting. Where water is limiting the practice is for the irrigation agency to allocate water to farmers; this system is known as supply-oriented. In between these two extremes are other combinations (see Clemmens, 1987, among others for a discussion).
4. NAZ, SP160/IP, Director of Native Agriculture to the Chief Native Commissioner, 30th Oct. 1944.
5. Alvord was responsible for laying the foundation for the current formal smallholder irrigation schemes in Zimbabwe.
6. NAZ SP160/IP, Agriculturalist, Department of Natives to the Chief Native Commissioner, 3 Feb. 1940.
7. NAZ SP160/IP, Assistant Irrigation Engineer to the Director of Irrigation, 1 Feb. 1940.
8. NAZ SP160/IP Agriculturalist, Department of Natives to the Secretary of Internal Affairs, 3 Feb. 1940.
9. *Ibid.*
10. NAZ SP160/IP Agriculturalist, Department of Natives to the Chief Native Commissioner, 2 Sept. 1941.
11. NAZ SP160/IP Director of Native Agriculture, Report on Irrigation Projects: Chipinga (n.d.)
12. NAZ SP160/IP Director of Native Agriculture to the Chief Native Commissioner, 5 Jun. 1945.
13. Agritex File, Chibuwe, Sparrow, M. 1983. 'Chibuwe Irrigation Scheme: History and General Data.'
14. Three pumps, one meant to act as a stand-by, were installed. However, the stand-by one has been sent for repairs. The pump operator reckons it is now about one and half years since it was sent for repairs.
15. The pump capacities are very suspect because they could not be verified as there were no records of the pumps in the Department of Water Resources in Mutare. Judging by the measured discharges (see Table 7.4) the pumps have a higher capacity.
16. A sum of Z$1, 000, 000 under the Public Sector Investment Programme (PSIP) has been earmarked for rehabilitation of the unlined canals in blocks C, D and E. Work has already started in block C where to date 20 hectares have been lined. The rehabilitation is in stages and it is envisaged that all the blocks will be concrete lined by 1996.
17. Agritex file, Chibuwe, Sparrow, M. 1983. 'Chibuwe Irrigation Scheme: History and General Data'.

18. "Blocks" in this sense refers to sections or parts of the hydraulic unit, in this case block A. The "blocks" represented different groups according to which farmers irrigated. The water bailiff does not know how the "blocks" originated. Farmers just know that they have always been there. What they know for sure is the "block" they belong to and also the sequence of irrigation in their own "block". Because of the common usage of "block", I adopt it in this chapter. However, I distinguish block as in block A, B, etc and "block" of the part of the hydraulic unit by using the latter in quotation marks, i.e. "block(s)".
19. Unless the water in the Save River is low such that pumping may jeopardize irrigation in blocks B, C, D and E. Such incidents are dealt with on the weekly Monday morning meetings where all water bailiffs, the extension workers, the supervisor, the foreman of the maintenance gang and the Irrigation Management Committee are represented. By that time, however, the water bailiff is forced to have acted in one way or another.
20. According to the bye-laws children are not supposed to irrigate in their own capacity as they are said to waste water. Because of difficulties of enforcing that rule, children are very much part of the irrigation scene. Some skip school to irrigate.
21. The gates are technically called undershot gates and are known to be difficult to control (see Plusquellec *et al.*, 1994). If they are used as discharge measurement structures they are even worse (*Ibid.*).
22. These are illegal in the sense that both of them are supposed to be in the block except during tea and lunch breaks. These breaks, it would appear, are compensating mechanisms by both to hedge themselves against long hours and generally poor salaries.
23. This could be due to low water levels for pumps to operate well or to the power problems which are the responsibility of the Zimbabwe Electricity Supply Authority (ZESA).
24. Such pump breakdowns tend to be frequent when the water level decreases in the river necessitating the need to remove sand around the intake. The pump operator removes sand immediately around the suction area. Sometimes he may be assisted by the water bailiff. Otherwise the Agritex maintenance gang is responsible for the general maintenance of the intake area.
25. The correct hydraulic explanation is that one of the gates is submerged while the other one is free flowing.
26. On this basis the supervisor tried to come up with a work schedule for water bailiffs (Appendix II).

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Appendix I. Duties of the water bailiff as written by the water bailiff himself

My duties

1. Distribution of water to farmers
2. Checking that weeding is done
3. Enforcing cropping programmes
4. Announcements of block meetings
5. Checking canal embankments that they are well maintained
6. Receiving visitors and answering questions posed by visitors
7. Recording of area irrigated daily
8. Record of water level (flume)
9. Zesa (electricity) reading
10. Watching against intercropping
11. Checking for straightness of crop rows
12. Checking for sub-letting

Appendix II: "Position Charter: Water Controller/Water Bailiffs, Agritex Chibuwe Irrigation Scheme, November 1994"

NAME .... POSITION CHARTER: WATER CONTROLLER

REPORTS TO

NAME .... POSITION: AEW

Key Objective
Purpose: To assist farmers to be self-sufficient and produce surpluses for sale through systematic agricultural management skills.

Servcies: To provide the following services:
1. Water management skills
2. Crop cultural practices
3. Efficient routine maintenance work
4. Administration

Target Group: To satisfy the identified needs of Chibuwe Irrigation Scheme farmers
Geographic: To provide these services throughout the Chibuwe Irrigation Scheme

WATER MANAGEMENT SKILLS
To maintain an efficient water management system which meets Agritex standards
Standards
Water Management
- Record time pump starts and stops
- Record canal and gauge amount of water per tertiary canal
- Advise the correct use and number of syphons/border strips
- Record time taken to irrigate 1.0 ha

- Record depth of irrigation after 24 to 48 hours
- Assess amount of water spilling into drains
- Recommend flow cut off two-thirds run of border strip

Water Distribution to Farmers

- Keep an update routine programme of who gets water and when
- Record crop and area irrigated
- Adjust routine to prevailing circumstances
- Withhold water from farmers who do not comply with rules and regulations of the scheme
- Water is allocated only to adults who may not be assisted by their own children

LAND MANAGEMENT

- Inspect plot boundaries that they are properly demarcated.
- Ascertain border strips are of the recommended measurement
- Bunds are of the recommended height i.e. + 23 cm
- Ploughing is done at a depth of 23 cm.
- Harrowing is done before planting in order to achieve a fine seedbed.
- No subletting is practised by farmers.
- Report veld fires
- Discourage indiscriminate cutting of trees in the scheme
- Report any stray animals.

CROP MANAGEMENT

To develop an efficient and effective crop management system.

Standards

- To ensure that crops (are) planted at recommended time.
- That only recommended types of crops and varieties are planted.
- That farmers do apply the recommended fertiliser types and amounts
- That farmers apply well-rotted and recommended amounts of manure
- Ensure that pests are effectively controlled.
- That farmers achieve recommended plant population for the type of crop
- Record area planted to each crop
- Crops are harvested in time and yields recorded.
- Crop residues are made into compost or made available to livestock as supplementary feeds or bedding.
- No stover is burnt

ADMINISTRATION

Develop and maintain an efficient administrative system which operates within Agritex rules and regulations.

Standards

- Cropping programmes are submitted.
- Winter = 15th September
- Summer = 15th March
- Seasonal report is submitted by 31st August
- *Facts and figures report is submitted by* 30/09
- Water level, ZESA metric readings, area irrigated and pumping hours report forms are submitted once a month

- Area planted for winter and summer crops are submitted weekly during relevant periods
- Call for farmer meetings
- Attend farmer and staff meetings
- Settle farmer disputes with AEW and IMC member

MAINTENANCE WORK

To ensure that plotholders comply with scheme maintenance rules and regulations.

Standards

Canals

- Maintenance of one metre canal bank
- That silt in canal is kept to a minimum
- Report any canal damages for immediate action
- Earth furrows must be kept free of grass
- Grass on canal edges must be kept short
- Report very low spots in earth furrows
- No washing of clothes and/bathing in the canals and furrows.

Roads

- Ensure bridges and grids are in good working order
- That mitre drains are in working order
- That road has no potholes, corrugates, tall grass or major damages
- No implements (ploughs, harrows, sledges, cultivators etc) are drawn on roads
- Road has a good clearance from tree branches

Fences

- Report any broken fences
- Report any stolen fences
- Ensure gates are in good condition
- Ensure gates are closed most of the time
- Ensure worn out droppers and standards are replaced in time
- Good maintenance of fire guards where applicable