

# **The Practice of Smallholder Irrigation**

Case Studies from Zimbabwe



Edited by  
**Emmanuel Manzungu**  
and  
**Pieter van der Zaag**

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**Emmanuel Manzungu**

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Harare, May 1996

# 1

## Continuity and controversy in smallholder irrigation

*Emmanuel Manzungu and Pieter van der Zaag<sup>1</sup>*

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Smallholder irrigation has been the subject of recurring discussions throughout Zimbabwe's colonial and post-colonial history. Both before and after independence on 18 April 1980, questions have been asked and answers sought with regards to the status of smallholder irrigation. This apparent interest in smallholder irrigation, however, does not correspond to its current contribution to the national economy (Rukuni, 1993a: 2; Rukuni and Makadho, 1994: 137). Smallholder irrigation covers a mere 5 per cent of the total irrigated area in the country, estimated at 150,000 ha (Rukuni, 1988a: 205; IFAD, 1994: 2, see Tables 1.1 and 1.2). According to Harvey *et al.* (1987: 143), the gross output from smallholder irrigation in the 1984/85 agricultural season was only 0.4 per cent of the total agricultural produce (cf. Peacock 1995). Why then has interest in smallholder irrigation been high among policy makers, academics, farmers and lay people?

**Table 1.1: Irrigation development in Zimbabwe according to landholding category**

Landholding category	Command area (ha)
Large-scale commercial	126,000
Parastatal estates	13,500
Small-scale settler ('outgrowers')	3,600
Communal and resettlement	7,200
<b>Total</b>	<b>150,300</b>

Source: IFAD, 1994: 2

**Table 1.2: Development of operational irrigated area in communal areas, 1949–1993 (ha)**

	1949 <sup>a</sup>	1961 <sup>b</sup>	1972 <sup>c</sup>	1983 <sup>d</sup>	1993 <sup>e</sup>
Manicaland	1,275	1,593	2,020	2,189	2,003
Zimbabwe	n.a.	n.a.	4,026	4,270	5,859

**Source:** (a) Alvord, n.d.; (b) Roder, 1965; (c) Hughes, 1974; (d) IFAD, 1994; (e) Zimbabwe, 1994

The answer to this question may be three-fold. Firstly, smallholder irrigation has always had a clear political content as it embodies land and water, two of the most contentious issues in Zimbabwean history in which colonial injustice is very obvious. In a country with an economy based on agriculture, land and water scarcity is crystallised in smallholder irrigation where there is little of each for so many. This has made these two resources assume the status of the pulse of the nation. Secondly, smallholder irrigation is viewed as capable of alleviating rural poverty, which is manifested by transitory and chronic hunger, malnutrition and unemployment (Jayne and Rukuni, 1994). Thirdly, smallholder irrigation offers the chance to modernize ~~peasant~~ agriculture. Modernization may result in smallholder irrigation contributing to the growth of local industries as well as to foreign currency earnings. In addition, it has been said that intensifying agricultural production in the communal lands through irrigation alleviates the increasing pressure on scarce land resources. No wonder smallholder irrigation schemes have been described as a foundation for rural growth (WMS, 1988; Makadho, 1994: 1).

The evidence from people's practices contained in this book has the broad aim of contributing to the on-going discussions on the future of smallholder irrigation development in Zimbabwe. This ambitious goal requires a thorough understanding of the existing body of literature on the subject. This chapter gives an overview of the major issues in smallholder irrigation, as addressed in the literature. The main dilemma in compiling such an overview is how to structure the material. One structuring principle can be chronology, as was followed by Rukuni (1985) in his comprehensive historical bibliography of irrigation research in Zimbabwe. But as our main objective is to filter out the major issues pertaining to smallholder irrigation, we had to search for a more suitable principle. This was not easy, as the literature varies widely in focus and scope, and contradictory conclusions are frequently reached.<sup>2</sup> On the surface, then, it is difficult to discern a common thread. Re-reading two of the first serious studies of smallholder irrigation published in the second half of the 1960s provided us with a clue.

Roder (1965) and Reynolds (1969) defined some major themes which are still relevant today. The issues they raised constantly resurface in the literature. Most of the later works offer data which are consistent with their findings. Importantly, some issues originally raised by Roder and Reynolds are later ignored (for instance, analyses of power in irrigation schemes). The work of both authors can usefully be taken as a point of departure around which the findings of more recent publications can be grouped. This structure is followed in the present chapter. It will help us with identifying the principal themes that define the complex field of smallholder irrigation in Zimbabwe. One consequence of this choice is that in the following text references to the works of Roder and Reynolds are frequent. This is merited, because their work was pioneering in many ways.

We start this review by briefly exploring *informal irrigation*, of which so little is known or recognised in the literature. The disregard of these furrows has resulted in the erroneous view that irrigation was brought to Zimbabwe by European settlers. There has also been an entrenched bias against irrigation practices outside the state's control. This leads us to a theme that pervades all 'official' smallholder schemes: *government control* and its implications for irrigation management. Next, two design elements, *crop choice* and *plot size* are reviewed. These are intimately related to the question of how government perceives its role in irrigation development. Subsequently, the question of the *economic viability* of schemes is discussed. This theme has strong historical roots, and is not unrelated to the question of who is responsible for what. This brings us to the role of farmers in smallholder schemes. A short history sketches the hurdles *towards farmer participation*. It is concluded that there are reasons to doubt government's sincerity in turning over schemes to farmers. The next theme looks into the *roles of women and men in irrigation*. A number of critical issues that require urgent attention or clarification are identified; e.g. women's access to irrigated plots, the irrigation type best suited to their specific needs, and the role of the extension service. Then we turn to the technical field, that of design of smallholder schemes. After observing that technical studies are few and far between, the conclusion is reached that since the mid-1980s a *Zimbabwean design tradition* has been emerging: Agritex is gradually building up its own brand of farmer participation in irrigation designing. We then take up the policy theme, and attempt to show the *policy and institutional fluxes* that began in the colonial and continued into the post-colonial era. The final theme in smallholder irrigation refers to the research method best suited to capture the object's multifaceted nature. Here we detail the methods adopted by Roder (1965) and Reynolds (1969) and compare with methods used in more recent studies. A *mix of methods* combining technical and socio-economic analyses, and grounded in quantitative and qualitative data emerges as the most adequate. The case studies that follow this chapter adopt methodological mixes in varying combinations and degrees.



### 'INFORMAL' IRRIGATION DEVELOPMENT

Literature on smallholder irrigation in Zimbabwe tends to focus exclusively on 'formal' irrigation. Formal refers to schemes initiated and constructed by government. These can be either government managed or community managed. There are also a few schemes considered 'formal' that were not government initiated but at one point in time were taken over by government, as is the case with the Mutambara scheme. The 'formal' bias paints a picture of an absence of irrigation systems in Zimbabwe that were initiated by indigenous cultivators and still run by them. Roder (1965), however, was well aware of these farmer-initiated schemes, and a few later authors refer to them but do not study them in any detail (Hughes, 1974: 186–7; Mupawose, 1984: A–7; IFAD, 1994: 2; Magadzire, 1994: 8; Chitsiko, 1995: 12). This sustained disregard for farmer-initiated furrows has had one major implication: until very recently irrigation was viewed to be a European introduction in Zimbabwe and no indigenous irrigation tradition was believed to exist in pre-colonial times (Watermeyer, 1981 cited by Rukuni, 1985: 85). Beach (1995), citing a revealing publication in 1923 by Machiwenyika, provides a definitive refutation of this belief: the Manyika people practised irrigation before the coming of Europeans.

Roder (1965) is one of the few people who studied farmer-initiated irrigation furrows. This work revealed that apart from internal problems (p95–100), there were other obstacles from outside the irrigator communities, for example, the Water Act of 1927, which heralded the control by government that would follow (p101). In the process of analysing these farmer-initiated schemes, Roder provides one of the earliest remarks on the interdependency of irrigators within one river catchment, and the disadvantaged position of black irrigators. Ever since these observations were written, farmer-initiated irrigation has been a neglected issue, except for the recent attention given to dambo-, vlei- or bani-cultivation (Lambert and Hotchkiss, 1990; Lambert *et al.*, 1990; Rukuni, 1993a; Meinzen-Dick, 1993a; Meinzen-Dick *et al.*, 1993: 32; IAP/WASAD, n.d.: 21; Mharapara, 1995; Andreini *et al.*, 1995; Bullock, 1995; Kundhlande *et al.*, 1995; McFarlane, 1995). This body of literature has demonstrated that dambo cultivation pre-dates the advent of Europeans, that it is self-sustained, highly productive and economically viable. The large extent of dambo cultivation (between 15,000 and 30,000 ha compared to only 6000 ha for formal smallholder irrigation) reflects its importance for providing food security to many households. These studies conclude that dambo cultivation is a viable alternative to government-initiated irrigation schemes, and that existing restrictive legislation regarding the use of dambos lacks a scientific underpinning.<sup>3</sup>

### GOVERNMENT CONTROL

Roder convincingly argues how, over the period 1935–1956, the government's grip on smallholder irrigation became stronger, culminating in attempts to implement

the Land Husbandry Act (Roder, 1965: 103–117).<sup>4</sup> Government control resulted in pressure on irrigators to:

- give up dryland farming, and not to leave the irrigated plots;
- produce surplus food crops for the market, and later cash crops;
- practise prescribed crop rotations, and plant on specific dates;
- pay water rates.

The rationale behind this policy is best explained by a contemporary observation (Hunt, 1958: ii):

Probably the most important single factor in raising yields is the provision of close supervision, either European or African, until plottolders generally realise more fully the requirements of irrigation farming. Where supervision is close the results are striking.<sup>5</sup>

Hunt suggests that supervision by management was always effective; and that it provided a secure environment for irrigators to operate. But Reynolds (1969) encountered a different situation in Nyamaropa. Six years after the scheme's construction there was a complete breakdown in communication between management and farmers. Reynolds (1969: 298) understood this to be a result of government staff viewing irrigators 'as children'. Staff, therefore, did not see the need for an organisational structure that would enhance the communication between them and the irrigators. However, farmers were far from being children and fully 'realised that their problems were managerial' (*ibid.*). Reynolds found that

the farmers were sophisticated and rational within their effective management field, but that they faced numerous barriers to their and the community's progress which were, in the main, not of their own making. (Reynolds, 1969: preface)

There were a number of factors that made farmers feel insecure. These included the institutional environment itself which was ill-comprehended by farmers, as well as strict regulations concerning irrigated crops and land tenure. Naturally the farmers' attitude was informed by these insecurities and aimed at circumventing control. Cash crops were too risky for many farmers who preferred to grow food crops instead. As to land tenure, the attitude of the irrigation staff had given many irrigators the impression that they did not 'own' their plot.

A few of the unsophisticated seem to regard themselves almost as employees of a plantation working for a boss, and are afraid of being kicked off their land if they do not follow orders. . . . suggestions of the LDO [Land Development Officer] often reach the cultivator as commands after passing through two levels of African intermediaries. (Roder, 1965: 172)

In this institutional context it is hardly surprising that many irrigators only half-heartedly cultivated their plots and were reluctant to invest much labour (Roder,

1965: 175). Roder's findings are echoed by Hughes, ten years later, when government had extended its control over all major aspects of the lives of the irrigators (Hughes, 1974: 186). Farmers were not 'very different from employees of the scheme management, the main difference being that the financial rewards they are offered are not in the form of a regular wage' (p214).

And yet, institutional power-play did not entirely stifle the irrigators. Reynolds (1969: 330) pointed to the 'financial, organisational and innovative dynamism' present among irrigators, and that they were making economic decisions that were 'close to optimal within the given conditions' (p303).

The relevance of the above pre-independence findings for the present-day situation is that management staff in irrigation schemes still provide services that are considered unreliable and inadequate by many farmers. This was documented by some recent studies on water distribution (for example, Pearce and Armstrong, 1990; Donkor, 1991; Makadho, 1994; Nyakudya, 1995). These technical studies confirmed the findings of Roder and Reynolds that the irrigation service generally is unreliable (cf. Rukuni, 1993a: 2). Makadho (1994: 200) observed that farmers are unlikely to improve their irrigation practices unless there is a reliable and timely supply of water. Makadho's extensive study further showed that water supplies tended to be less reliable in government-managed schemes than in community-managed schemes. Respondents (all Agritex staff) to a questionnaire by Makadho (1993: 33-37) identified 'shortage of water' as the most important problem facing smallholder schemes, followed by 'poor managerial ability'. Data provided in the same study, however, indicate that despite 'water shortage', Agritex schemes wasted nearly twice as much water as community schemes in the 1991 winter season (Makadho, 1993: 30). It could therefore be suggested that 'poor managerial ability' resulted in 'water shortage', indicating that the central issue in smallholder irrigation is management.

## CROP CHOICE AND PLOT SIZE

The previous section has shown that government control over smallholder schemes has firm colonial roots but remains an unresolved issue up to today. In this section, we want to show that government's wish to control informs seemingly straightforward design decisions on crops to be irrigated and the size of plots to be allocated to irrigators. These design decisions also result from the government's policy regarding such issues as food security, import substitution and resettlement of displaced farmers.

### **Dryland versus irrigated agriculture**

The decision of what size of plots to allocate to irrigators (plotters) is intimately related to the question of whether irrigators should continue with or give up dryland cultivation. This first became an issue in 1936 (Roder, 1965: 110) and is still one 60 years later. Some schemes constructed after 1980 had small plots and were meant to

combine irrigated with rainfed agriculture. Most new schemes, however, have plot sizes meant for full-time irrigation farming. Even in schemes with larger plots, irrigators are often reluctant to give up dryland cultivation. Their dryland plot provides some minimum level of security; or at least is a known factor, whereas for many, "irrigation" is uncharted territory. Makadho (1984: 213) incisively observed that:

- Risk avoidance is one of the factors that characterise all small farmers. Even though irrigated crop production in itself is less risky than dryland farming, the very dependent status of the tenant farmers, *vis-a-vis* the scheme management with regard to water supply, use of machinery and inputs implies great risks for them. Also the farmers' dependence on one single cash crop (sic), which gives them a bulk cash income once a year, implies great risks.

It is therefore understandable that irrigators tend to retain their rainfed land after joining an irrigation scheme (Rukuni, 1988b: 3). Where irrigated plots are meant to provide a full-time occupation, government staff tend to view dryland agriculture by irrigators as 'illegal'. It is also alleged that dryland agriculture takes too much of the irrigator's time at the expense of the irrigated crops. Whether the government may prohibit access to dryland cannot be decided on technical grounds alone, and is a socio-political question (Rukuni, 1988b: 10).

### Crop choice

Government started to interfere with irrigators' crops from about 1936. First, plottolders were pressed to grow food crops for sale (in order to pursue the famine relief objectives of government), then a compulsory crop rotation of beans and wheat was introduced, and later sunhemp was included (Roder, 1965: 111). During the first half of the 1960s, cotton was introduced (Reynolds, 1969). From the start, irrigators appeared to have distrusted cash crops. They were at the whims of crop disease, transport and markets,<sup>6</sup> things beyond their control. It was therefore quite a sound strategy for them to concentrate efforts on those food crops which could satisfy their own subsistence needs and had a wide market (including their own informal market networks). Maize was such a crop, and later also wheat, when bread had become an accepted staple (Roder, 1965: 133). But continued maize cultivation often clashed with the official crop rotation. Not following the recommended crop rotation was considered 'illegal'. As one irrigator in the early 1960s complained: government lays down what to plant, when to plant and where to plant (Roder, 1965: 172). By 1974, the situation had become excessive:

- technical and economic imperatives make it essential to ensure that plottolders should cultivate their plots in the manner approved . . .  
The main devices used to bring about this increase in managerial control . . .

have been the introduction of lease agreements and the appointment of scheme managers . . . the "managerial bureaucracy" specifies the precise areas of which crops each plotholder will plant, final planting dates for these crops, which types of seed will be used, and what quantities of which types of fertilizer will be applied. . . . Plotholder are also bound, in terms of their leases, to obey the orders of the managers in respect of such activities as weeding their plots and being present at predetermined times to take water. (Hughes, 1974: 213–214)

The situation is somewhat changed today but irrigation staff still interfere with irrigators' preferences. Bourdillon and Madzudzo (1994) reviewed the situation of six schemes, all built after independence. They found only one scheme, Shamrock, in which irrigators were free to decide which crops to grow. This was also the most successful scheme of the sample. The authors clearly suggest that freedom of crop choice correlates positively with performance. Yet irrigation is a typical form of planned development, and many government staff and planners find it difficult to suppress the urge to at least advise on the question of crops. To date, many economists maintain that the only economical way of utilizing expensive irrigation infrastructure is through the production of 'high value' crops which 'are the most efficient users of irrigation investment (while) food crops are the least' (Jansen, 1993: 42).

However, once planners interfere with farm decisions, problems are bound to emerge. How, for instance, can planners weigh the labour constraints of a particular household against that household's objectives, which may include food security, a cash income, providing proper care and education to children, and probably a host of other objectives as well? A recent study found that the preference for 'multipurpose' crops, a strategy followed by many irrigators ever since the 1930s, may have been sound after all:

Irrigated maize cultivation offers a compromise between the high margins of horticultural production, and production stability, and food security. (Meinzen-Dick *et al.*, 1993: 34)

Irrigation staff, then, should be careful about making decisions for the farmer. Makadho (1984: 217) emphasised that farmers try to integrate irrigated agriculture 'into a new, balanced farming system', and that they will only succeed if 'the basic farm management responsibilities' are placed into their hands (cf. Nzima, 1990: 382).

### Plot size

Reynolds wondered about the plot size in smallholder schemes, observing that 'there has never been any criteria applied to determine the size of a holding on an irrigation scheme' (Reynolds, 1969: 10). He inferred that the plot size, which had become

'standard' by 1966 (4 acres for male plotters and 2 acres for widows), was an 'historical accident' (p11) informed by the government's wish to resettle as many people as possible, and to encourage the adoption of more intensive cultivation practices. Hunt would have disagreed. To him 4-acre plots (1.6 ha) made a lot of sense:

four acres of irrigated lands seems the size which a family consisting of a man, one wife and their children working with the simple tools at present at their disposal can handle adequately alone, especially where labour consuming crops such as green peas and green beans take a place in the rotation. (Hunt, 1958: 21)

Hunt was also of the opinion that smaller plots were less economical (Hunt, 1958: iii).<sup>7</sup> The only problem he had was with the fact that widows were given 2 acre plots; far too much to his liking.

After independence, the Derude (1983: 4) policy document stated that for those schemes designed for full-time occupation 'plot sizes should be in the range 0.5 to 2.0 hectares per irrigator'. Two choices are important as far as plot size is concerned; giving as many people as possible access to irrigation, or providing an economically viable enterprise (Meinzen-Dick *et al.*, 1993: 17, 34; Nyoni, 1990). Depending on the way one looks at it, both small and large plots are advantageous:

large plots [ $>1.4$  ha] realize larger farm income but small plot [ $<0.8$  ha] farmers are more efficient users of the resources available to them.  
... In terms of farm incomes, productivity and settling more farmers  
... 1 to 1.2 ha is optimal. (Rukuni, 1988b: 8-9)

The smaller the holding size the more important it is for farmers to grow high-value crops, but often it is farmers with larger holdings that are able to grow them. Crop choice is often more restricted on smaller holdings (Meinzen-Dick *et al.*, 1993: 16; Rukuni, 1984a; Tiffen, 1990).

These may be valid statements, but hardly solve the dilemma for planners: whereas Chitsiko (1995: 32) asserted that relatively large 1.5 ha plots per farmer were viable, Meinzen-Dick *et al.*, (1993: 34) emphasized that efficiency of resource use provides an important argument in favour of small holding sizes. In their extensive survey they found that gross margins per unit land and water are generally higher on schemes with smaller holding sizes, because they are more intensively cultivated. In sum, and despite the many references in the literature on crop choice and plot size, the matter remains contentious. As if in recognition of that fact, a committee to look "into the plot size issues" was formed as a recommendation of the Agritex Irrigation Branch Conference held in Bulawayo in 1993. The committee's findings have not been available.

## THE ECONOMIC VIABILITY CONTROVERSY

### Government subsidy

By 1958, government was concerned about the economic viability of irrigation as it realised that it was subsidizing projects (Hunt, 1958; Roder, 1965: 125).<sup>8</sup> At the time, a water rate of 25 shillings per acre was charged, equivalent to one 91 kg bag of maize (or some 230 kg per ha).<sup>9</sup> As a result, the irrigation policy committee recommended in 1960 that any future projects should be development projects aimed at repayment of maintenance and capital costs (Roder, 1965: 136). In the 1973/74 financial year, shortly after the water rate was increased to \$70 per hectare, the water rates collected covered some 38 per cent of government expenditure on maintenance of irrigation schemes (Hughes, 1974: 197). The 1973 increase of the water rate was hefty and designed 'to discourage poor producers from staying on irrigation schemes' (p213). At the same time it became more difficult to obtain agricultural loans (p195). As a result irrigators had to supplement 'the meagre incomes from their irrigated plots' (p198). Hughes mentions a scheme where, irrigators having become indebted, the local Headman had said 'Let the government stop irrigating the land and give us back our fields' (p217). Policy makers and planners had similar sentiments, as the 'consensus of opinion was that present rates of production from these schemes do not justify the amounts required to subsidise their operation' (p196).

By 1981, water charges contributed only 15 per cent of the total operation and maintenance costs incurred by government (Pazvakavambwa, 1981: 6). This dropped to 11 per cent in 1983 (Rukuni, 1988a). After the increase of the water charge from Z\$70 to Z\$145 per hectare in 1984, the fees collected, for instance in Manicaland, was equivalent to 32 per cent of total government costs, in Midlands 17 per cent and in Masvingo province 13 per cent (GKW Consult, 1985: 91). The new maintenance fee was no joke: it was then equivalent to some 1100 kg of maize, and aimed to put the contribution of irrigators to the running costs of the schemes at between 20 and 25 per cent (Derude, 1983: 11). At the same time, Derude had calculated that this new fee would represent approximately 15 per cent of the net production value by an 'average' farmer (Derude, 1983: 34).<sup>10</sup>

Since 1984 the maintenance fee has remained the same whilst costs have soared, hence government's share in running costs increased again.<sup>11</sup> This meant that government was increasingly subsidizing smallholder irrigation: in 1993 estimated at Z\$33 million (Peacock, 1995: 4), equivalent to some Z\$5000 per ha per year (US\$700).<sup>12</sup> By 1995, the maintenance fee covered less than 4 per cent of operation and maintenance costs (Peacock, 1995: 44).<sup>13</sup> As a result, plotholders enjoyed relatively cheap access to irrigation water and tended to operate profitably (Rukuni, 1993b: 3).

### Government's role

<sup>6</sup> The controversial point is that while it is acknowledged that smallholder irrigation is worthwhile if not crucial for Zimbabwe, it privileges relatively few irrigators

while the majority of dryland producers are left to their own devices. In the words of Jansen (1993: 43), 'Irrigation subsidies . . . benefit very few very much'. Some authors, therefore, do not want government to further invest in smallholder irrigation, but to invest instead in areas with higher returns and which would benefit more people. Others maintain that irrigation development is typically a task that government should assume, as it contributes to the objectives of redressing historical imbalances in access to irrigation, to increasing food security, and to broader welfare objectives. Many schemes in communal areas may not operate profitably, but it should not be forgotten that they 'were not designed to be financially viable in the first instance' (Rukuni, 1988b: 18). Pazvakavambwa (1987: 2) suggested the introduction of the term 'social schemes'. In this line of reasoning, 'the capital costs involved in smallholder schemes should be shouldered by government, while irrigators should at least assume all running costs (Mupawose, 1984: A-11; Rukuni, 1988b: 17). Water has been supplied to the irrigation sector at subsidised rates.<sup>14</sup> One way of rationalising water charges, it has been suggested, is to charge farmers volumetric rates for irrigation water consumed instead of a flat per hectare rate. But this may not be practical because of difficulties in measuring the actual amount of water used by each farmer (Derude, 1983: 12).

If one important government objective was to redress historical imbalances regarding access to water, one could well argue that in new smallholder schemes irrigators should be exempt from re-paying (part of) the investment costs of the storage facilities required (the irrigators paying all running costs and a share of the capital costs related to the canal system itself). The argument would be that in the 1940s and 1950s commercial farmers received a 50 per cent financial subsidy for building dams, while technical design and advice was free (Zimbabwe, 1994: 25),<sup>15</sup> and that it is now the turn of smallholders to reap similar benefits.<sup>16</sup>

One problem with the planning of new schemes is that writers of project reports tend to exaggerate the expected financial returns. The data used are often unrealistically optimistic, a point first made by Roder (1965: 137) and more recently by Jansen (1993: 36, 39). At the same time, and here all authors who have contributed to the above discussion agree, the costs of irrigation development in Zimbabwe are very high.<sup>17</sup> Suggestions have been made on how to keep costs low: irrigators should contribute labour during construction, designs should be simplified (Pazvakavambwa, 1987: 2); existing uncommitted storage capacities should be utilised before embarking on schemes requiring new storage facilities; efforts should be concentrated on low cost gravity schemes where financial viability may be 'low but a scheme is essential for food security', and schemes equipped with pumps and costly storage works should be restricted to cases where it is financially viable (Rukuni, 1988b: 17); and drastically cut cost of dam construction, especially by means of doubling the risk factor (FAO, 1990: 40, Zimbabwe, 1994: 27, Peacock, 1995: 45). The above suggestions are meant



to bring down costs. To further improve economic viability, output value should increase. One of the most important pre-requisites would be to increase the reliability of water supplies through more adequate system designs and improved management structure. It has been further suggested that farmers should be fully committed to the scheme or else all efforts will be in vain (Pazvakavambwa, 1984b: 423; Peacock, 1995: 47).

### Maintenance fee

While there seems to be a consensus about the need to revise the basis of water charges, there are many accounts in the literature of irrigators' reluctance to pay, even when charges are relatively low. This reluctance has strong historical roots: before independence water rates were seen as 'the only thing District Commissioners used to care about' (Pazvakavambwa, 1981: 6). It is illustrative that the name of the fee itself was the subject of some concern. Already in 1958 there was a suggestion to change the name "water rate":

This name could give a false impression so that in a year when water supplies could not be maintained, as in Mutema in the winter of 1957, plottolders might well query why they should pay a full water charge when water was not being supplied. (Hunt, 1958: 24)

Hunt appears to downplay the importance to irrigators of the reliability of water supply.<sup>18</sup> He suggested as an alternative the term 'irrigation charge', in order to avoid 'any future misunderstanding'. His suggestion was, however, never adopted, but the point was understood by Derude, who had to cope with an even greater reluctance among irrigators to pay the water rate immediately after independence (Pazvakavambwa, 1981: 6). Derude thus proposed to change the term "water rates" to "maintenance fees", 'which is more acceptable to irrigators' (Derude, 1983: 11).<sup>19</sup>

Whatever the name of the charge, irrigators have been surprisingly consistent in their reluctance to pay the fee. This may indicate that farmers do not wish to make financial contributions if they are not given concomitant say in how these monies are spent. The point has been made by Makadho (1994: 185): 'It is frustrating that the money farmers pay for maintenance charges . . . goes to the treasury'. This tends to alienate the farmer, who would prefer 'the maintenance fee to be ploughed back into the irrigation scheme by way of purchasing tangible materials and equipment for that specific scheme'. Rukuni added a similar plea that scheme-specific rates, which would reflect real running costs, would allow Agritex to identify viable schemes which could run on their own, and those schemes that would need a continued subsidy (Rukuni, 1988b: 20).

It should be clear by now that **IMCs** financial or economic viability, the paying of the maintenance fee, and the involvement of farmers in management are intimately related. It is, then, no coincidence that **Irrigation Management Committees**, introduced after independence, were not only meant to improve coordination between irrigators and management, but that they were also 'viewed as a starting point of a process whereby irrigation subsidies can be steadily eliminated in an equitable manner' (Rukuni, 1988a: 206).

## TOWARDS FARMER PARTICIPATION

Both Roder and Reynolds found a lack of proper communication between irrigators and administrators (see above). Roder (1965: 9) considered the lack of accountability of colonial administrators to irrigators a major cause. Staff did not depend on farmers' wishes and had no 'understanding or tolerance of the African economic condition'. As a result, they disregarded any feedback on their directives and instructions they might have got from irrigators.

The gap between irrigators and management was to remain a recurring issue. Reynolds pointed to a development not planned for by government that somehow filled the vacuum between irrigators and management: the advent of producer cooperatives (Reynolds, 1969: 12). He concluded that until 1967 the cooperatives were the only avenues for contact with government (p13). Little is known how these and other emerging intermediate organisations fared through the 1960s and 1970s. Hughes (1974: 217) provides a scant reference to the existence of a Kraalheads' Association in Nyanyadzi which appeared to have played an important role in the day-to-day running of the scheme. Such intermediate organisations became a focus in the struggle for independence during the 1970s. Farmers who became members of such bodies were considered sell-outs and were victimised (Pazvakavambwa, 1984b: 421).

Derude introduced Irrigation Management Committees (IMCs) into smallholder schemes from 1983. These committees were meant to liaise and assist in the management of irrigation schemes (Rukuni, 1988a: 206). More specifically, they would:

- enhance farmer participation in management and decision-making at the local level;
- prepare the farmers for a complete take-over of management functions;
- create a responsible attitude and a sense of belonging to the scheme;
- introduce self-regulatory, self-disciplining machinery at the irrigation scheme in order to enhance the maintenance of discipline, cropping patterns and recommended agronomic practices (Pazvakavambwa, 1984b: 423).

Furthermore, these committees would help to 'tap the farmers' innovativeness' (p426) and bridge the gap between irrigators and management (Makadho, 1984: 9). These intentions made a lot of sense. But as early as 1984, Pazvakavambwa (1984b: 424-25) discerned some emerging institutional problems:

- there still existed an element of mistrust between farmers and management;
- there was confusion about the roles of the IMC and the recently introduced district councils;
- there was no proper legal framework, hence by-laws could not be enforced.

Ten years after these observations were made there is still reason for concern, as 'not much progress has been made' towards a policy in favour of community-run

schemes (Rukuni, 1993a: 2). This notwithstanding, there is a growing realization that community schemes are at least as effective as schemes run by Agritex (Makadho, 1993, 1994), and that consequently 'the decision making on water distribution activities should be the farmers' responsibility' (Makadho, 1994: 181-2). But government personnel may lack the motivation to bring this about (Makadho, 1990b: 14). Bourdillon and Madzudzo (1994: 11) suggested that Agritex needed to reflect on ways of monitoring the operations of their extension officers, and that the emphasis of agricultural extension to irrigators 'should be on training for independence rather than control'. Another worrying point is that the IMC had still no legal status by 1995, despite calls made by Makadho (1990a) and Chitsiko (1995: 15). Irrigators, then, might have reason to doubt government commitment. So did Makadho when he stated that 'There is no obvious preparedness by government to hand over responsibilities and control to IMCs' (Makadho, 1994: 203).

#### THE ROLES OF WOMEN AND MEN IN IRRIGATION

Irrigation development for smallholders by government has always focused on 'the plotholder'. The plotholder was taken to be a man who headed a household consisting of 'himself, one wife and their children' (Hunt, 1958: 21). This picture reflected a European nuclear household, where the man was the main producer and provider of cash income and the wife provided reproductive functions. A woman would, according to this image, lack the resources, skills, physical power but also the ambition to qualify as a plotholder in her own right. Some government officers thus found it incomprehensible that women, mostly widows, were given plots in the schemes. Hunt, for instance, found this a wasteful practice. He observed that these women lacked sufficient resources to use the plots profitably, and therefore recommended the reduction of the number of female plotholders by re-examining their rights to hold land (Hunt, 1958: iv).<sup>20</sup> Ten years later, Reynolds came to a very different recommendation, echoed 25 years later by Dikito (1993: ii). Reynolds's recommendation was that: 'women should also sign all documents related to settlement and should attend the Authorities proposed farm school prior to the tenants occupation of a farm' (Reynolds, 1969: 330).<sup>21</sup>

Only well after independence did the roles of women and men in smallholder irrigation become a subject of concern to policy makers and planners, and the object of more systematic inquiry. Yet the body of literature addressing gender issues is still thin. The findings of these studies can be pragmatically grouped into three broad categories: (a) those findings related to labour (time) and (access and rights to) land; (b) those related to agricultural technology (including irrigation design) and to extension and training; and (c) those related to the marketing of crops, control of the proceeds of the harvests, and to irrigation management.

### Labour and land

There is general agreement that irrigation increases the work load of the household, and that in general the female members of the household have to shoulder most of this increase. Women find it much more difficult than men to combine their many tasks (Madondo, 92: iv; Dikito, 93: i), some of which are fixed (in time) and frequent. Yet women are keen on having access to irrigated agriculture; apart from securing household food requirements, it is a potential source of cash which may cover typical household outlays such as food purchases, clothing and school fees. However, access to irrigated agriculture is often less secure for women than for men. It is normally the male adult in a household who is registered as the official plotholder, and this may have important implications for who controls the benefits of irrigated produce, especially cash crops.

The uncertainty surrounding the rights of a woman to a plot registered in her husband's name seems to erode her decision-making rights (Chimedza, 1989: 35). It has been recommended that women's access to irrigated plots should be made more secure (Chimedza, 1989: 36; Chabayanzara, 1994: 8), and for the wife and husband to be jointly registered 'with a clearly stated proviso that the wife takes over the plot in the event of the husband's death' (Dikito, 1993: ii). A contentious issue is whether women should qualify for plots in their own right. This, of course, is especially relevant for female-headed households. Mvududu (1993: 18-19) claims that this should, in fact, not be an issue at all, as women are considered majors in their own right, and hence should be able to register plots in either their own or their married name. In principle, then, women's status should not matter so long as she satisfies the selection criteria (*ibid.*). But these selection criteria tend to disadvantage women. A requirement is often to have a Master Farmer Certificate, which few women farmers have. Also, local leadership is normally involved in compiling a list of potential irrigators for a new scheme. These leaders may not regard women as qualifying for plots (Mvududu, 1993: 17).

### Technology and extension

It is often suggested that women would find it more difficult to adopt a new technology, such as irrigated farming. Chimedza (1989: 20), however, found that many were coping very well. This would come as no surprise, as women tend to spend more time in the field than men and carry out most of the actual irrigation tasks (Dikito, 1993: iv). Women also tend to have clear preferences regarding the type of irrigation. Chimedza (1989: 12-13) gives the example of some women in Tagarika scheme who disliked the sprinkler technology. Because they lived quite a distance away from the scheme they had to spend long hours waiting to change the position of the sprinklers every two or three hours, while they were still responsible for the household work and dryland farming. The situation was particularly difficult during term time when school children were not able to help.

Madondo suggested that women's preferences between canal and overhead systems be studied (Madondo, 1992: vi). Dikito agreed that the effects of irrigation technologies on women should be a priority area of research (Dikito, 1993: v), contending that overhead irrigation was labour demanding (Dikito, 1993: iv-v, 19). Irrigated agriculture confronts men and women with new techniques, new crops, and an increased need to budget and plan their enterprise. The agricultural extension service is supposed to provide guidance on these issues. There is controversy about the differential impact of the extension service on men and women. Some maintain that 'a farmer is a farmer', and by so doing obliterate the gender issue (e.g. Pazvakavambwa, 1988: 8), while others, such as Mvududu (1993: 6), maintain that such an understanding of the socio-economic conditions of the people concerned is ill-founded. Dikito (1993: ii) argues that the extension service is biased in favour of cash crops, while food crops are considered very important by women. She therefore recommended that Agritex should take the food crops more seriously.

### **Markets and management**

Despite the fact that irrigated agriculture tends to increase the work load, and may give rise to disputes within households, it is often welcomed by both female and male farmers. It may benefit the female farmers, although their male counterparts may benefit more (Chimedza 1989: 35, Mvududu, 1993: 17). A crucial issue here is who controls irrigated produce within the household, and who controls the cash income derived from it. This is often directly related to who is registered as the official plowholder. But, generally, as more cash becomes available in the household women also are able to control a proportion of it (Chimedza, 1989: 35). This depends greatly on access to markets. In one study it was found that men dominated the marketing of major crops while women dominated and preferred informal marketing of vegetables and poultry products (Chimedza, 1989: 25-26).

The issue that remains untouched is women's roles in a scheme's management, which has sometimes been down-played. It appears that in many irrigation schemes women are voted onto the Irrigation Management Committee (not infrequently as treasurer). Training in leadership, book-keeping and other organisational skills could further increase the role women have to play in management (Dikito, 1993: iii). It is especially important that women learn to communicate their views and problems more effectively (Chimedza, 1989: 36).

### **TOWARDS A ZIMBABWEAN DESIGN TRADITION**

This review so far has shown that social, economic, political and organisational issues are often directly related to technical design elements of an irrigation scheme. There are few publications that address technical irrigation issues.<sup>22</sup> There are even fewer authors who take it upon themselves to improve existing design concepts of smallholder schemes, and to explore new ones.<sup>23</sup> Consequently, the study of

smallholder irrigation in Zimbabwe appears to concentrate on social, economic and most importantly, agricultural objectives and considerations (cf. Meinzen-Dick, 1993b: 29).<sup>24</sup> In this section we wish to review those publications which implicitly or explicitly address design and planning issues. We will start again with Roder (1965).

### **Simple or complex technology**

Roder concluded in 1965 that with the increasing number of irrigation schemes, the most favourable sites as to water availability and soil quality had already been occupied, making it necessary for later schemes to be equipped with night storage dams and pumps. Furthermore, poorer soils were brought under irrigation. As a result, these schemes were more complex and expensive to operate (Roder, 1965: 149). At independence all smallholder schemes had open-canal systems with two schemes having sprinkler sections (Derude, 1983: 2).

During the 1980s there was a consensus that smallholder schemes should be simple, robust and low cost (Derude, 1983: 2; Pazvakavambwa, 1987: 2; Rukuni, 1988b: 17; FAO, 1990: 35; cf. Rukuni, 1995). It was argued that such technology would be more sustainable and would facilitate farmer participation. But by 1995, the highest Agritex officer in charge of irrigation said farewell to the simple technology philosophy by arguing that new technologies would save enormous amounts of water (Chitsiko, 1995: 15). He further disagreed with the widely held belief that 'sprinkler and drip systems are more difficult for the smallholder, compared to surface irrigation'. He, instead, argued that sprinkler and drip systems had 'more in-built management when compared to the latter' and were therefore easier to manage.

### **Design approach**

Generally, one can say that up to the mid-1980s, changes in the preferred type of irrigation technology for new schemes were made as the need arose. The development of smallholder designs, then, had been a haphazard process (Pazvakavambwa, 1988: 1) and not one which was carefully planned. Design decisions were often made implicitly. There was no apparent link between how designs were made and how the schemes were subsequently used. Design reports apparently lacked information about how the schemes, once they were constructed, had to be operated. According to Pazvakavambwa (1984a: 95), this was one of the reasons for their low performance. A lack of adaptive research resulted in farmers taking up 'unauthorised practices which they have now adopted as the norm' (p98), 'often with disastrous results' (p95).

During the second half of the 1980s, Pazvakavambwa and Makadho became the two major forces behind a participatory approach to designing smallholder schemes (Makadho, 1984: 218; Pazvakavambwa, 1984a: 98; 1988: 5, 8).<sup>25</sup> These high placed Agritex officers argued that future irrigators had to be involved right from the planning

stage. 'All the preliminary investigations are carried out with the help of the community. They are more familiar with the local custom than our Irrigation Specialists' (Pazvakavambwa, 1988: 5). Farmers would be given a chance to choose between two or three alternative designs. The approach has been described by Makadho (1990b: 9–10) as follows:

Once the farmers have committed themselves the engineers from the Irrigation Division [elaborate] detailed designs for infield works . . . The alternative designs are explained to the farmers, i.e. the advantages and disadvantages of each in terms of method of operation, capital cost (which farmers have to borrow under the NFIF [National Farm Irrigation Fund] programme), replacement cost, operational costs and management requirements. The alternative designs usually include drag-hose, semi-portable sprinkler system and where possible a surface irrigation option. Designs are made in such a way to accommodate the farmers expectations as much as possible./

With this approach the controversy about complex or simple technologies was laid on the plate of the future irrigators. In conclusion, it appears that the Agritex Irrigation Branch has managed, over the last 10 years, to come up with its own brand of farmer participation in irrigation designing. This has now been perfected into a systematic design approach, coupled with the capacity to design a number of technical options considered appropriate (and not necessarily 'simple') for the local context.

### **Water scheduling and water turns**

Efficiencies are said to be low in smallholder schemes and much water is wasted. Makadho argued that winter crops receive adequate water despite all the wastage and unreliable supplies simply because farmers and irrigation staff behave as if evaporation in winter is as high as in summer. One factor which makes water available in winter is that the cropped area in winter is reduced (Makadho, 1993: 41; cf. Makadho, 1994: 196). Makadho estimated that the area under winter irrigation could be boosted by about 50 per cent, if the water was used more effectively (Makadho, 1994: 196). It has been suggested that water wastage can be addressed by proper water scheduling based on actual crop water requirements (for example, Hoccht, 1990).<sup>26</sup> This would inevitably require a greater, if not complete, control over water flows by management. Others have argued that before addressing the issue of water wastage, the issue of highly unreliable supplies should be tackled.

This second line of reasoning is followed by Tiffen and Harland (1990b). They observed that in Nyanyadzi each farmer takes water for as long as needed (cf. Makadho, 1994: 157, Table 6.15), that turns are unpredictable, and that during water shortage this leads to unacceptable long intervals and inequity. They proposed a

time-based roster of irrigation turns that is fixed: each farmer would get a precise time allocation, normally proportional to the land that a farmer owns, but adjusted, if needed, for reduced flows in the lower reaches of the canal system. Depending on the amount of water in the canal, this would enable the farmer to water all or part of his land. Tiffen and Harland argue that such a system 'is more equitable than that operating in Nyanyadzi since in water-short years each farmer, whether at the top or bottom, will have time to water only part of his land' (Tiffen and Harland, 1990b: 48). They recognize the trade-off between reliability and ease of management on the one hand and satisfying crop water requirements on the other. Tiffen and Harland clearly choose to prioritise the first.

The way irrigation turns are arranged has implications for the design of distribution structures in the canal network. For instance, it impacts on the level in a scheme below which water is delivered intermittently (cf. Shanan, 1992). It is a pity that no publications have been found that address this important design implication. The Agritex irrigation manual simply states that there are three delivery methods, *viz* continuous, rotational and on demand (Savva *et al.*, 1994: 373), and that in most smallholder schemes a rotational delivery is followed. In many schemes, however, such rotations are not clearly defined. No schemes in Manicaland, except for one, had 'set rules for operating the rotational system' (Agritex, 1989: 21).

### **Designing for farmer management**

Management problems abound in smallholder schemes (see above). Managing a larger scheme appears to be more complicated than a smaller scheme. Roder had already reflected on the ideal scale of schemes, referring to contemporary studies some of which favoured larger scale schemes which were supposed to achieve high efficiencies because of economies of scale (Roder, 1969: 9). Others preferred smaller schemes because of the supposed smaller gap between irrigators and management (*ibid.*). Roder considered all the schemes he studied as 'small' in scale. He concluded that 'the greatest reward of developing a series of small projects appears to lie in their compatibility with the existing regional economy.' He also found that in the Rhodesian schemes there was no 'close association between farmers and agriculturists which was said to be an asset of small development' (p205). Peacock, referring to a recent World Bank report, maintains that small irrigation development has no distinct advantage over large scale developments. He argues that large irrigation schemes are more likely to succeed than smaller ones, simply because 'larger schemes attract better managers, and because borrowers are more disposed to take the actions necessary to ensure that larger, more visible schemes succeed' (Peacock, 1995: 48).

If this is true, and if it is also true that management becomes more complex with increase of scale, then questions should be asked as to how the technical design may make management easier. One way of easing this situation is by creating one or more intermediate management levels in a scheme, parallel to system levels



(Makadho, 1994, Tiffen and Harland 1990b). Tiffen and Harland (1990b: 54) proposed to break the 400 ha Nyanyadzi scheme down into more manageable components. In their proposal, the lowest management level would be formed by 'field channel groups', each with their own intake. The second level would be formed by channel groups 'federated into a block which also has its independent water source, or intake from the main canal.' Makadho focused his discussion on this second, block level (Makadho, 1994: 190). With the channel group concept in mind, Tiffen and Harland (1990b: 54) suggested that, for new schemes, each field channel should supply water to some 8–25 farmers, 'as Zimbabwe experience in settlement schemes has shown this to be a good size for a social unit'.

In sum, Agritex has made strides in training irrigation staff in smallholder design, as is reflected by the production of a comprehensive irrigation manual in 1991 (Savva *et al.*, 1994). There are many decisions taken during the design process of smallholder schemes, either implicitly or explicitly. These decisions reflect how a design, once implemented, is supposed to be operated. Design manuals should, therefore, incorporate the expected operational criteria (Pazvakavambwa, 1984a: 97). The irrigation manual is an important step towards achieving that objective.

## POLICY AND INSTITUTIONAL FLUXES

Throughout this review reference has been made to a number of policy elements that preoccupied both the colonial and post-colonial administration. Reference has also been made to the various institutions involved. What we want to do in this section, in summary form, is present some of the highlights regarding these two subjects.

One notable feature before and after independence was that irrigation policy was never adequately developed. Referring to the post-colonial era, Makadho (1994: 20) remarks that 'irrigation policy is not in black and white: it is only understood'. There was, however, a heavy dependence on the 1983 Derude document, which has been the most definitive statement of irrigation policy (Meinzen-Dick, 1993b: 35). About ten years later there was a FAO-assisted draft irrigation policy document (Zimbabwe 1994), which by December 1995, was under consideration by the government (Makadho, pers. comm.). We shall not comment on the draft policy.

Suffice it to say that the lack of an irrigation policy in black and white has been lamented by a large number of observers (Roder, 1965; Mupawose, 1984: A-12; Magadzire, 1994: 10, Chabayanzara, 1994: 6, Chitsiko, 1995: 13). The lack of clear policy objectives should be partly attributed to the nature of this subsector, in which a great many different players have a stake.<sup>27</sup> A critical need has been identified to improve the coordination and communication between the different technical communities involved and the political authorities (Makadho, 1994: 201). The stated policy objectives, however, are interesting to examine in some detail.

### Stated policy objectives

Originally, with the development of smallholder schemes government aimed at enhancing food security. Later, the main objective appeared to have been to resettle black farmers thrown off white farms, and by 1960 this same objective still held, but in future projects irrigators were supposed to repay maintenance and capital costs. By 1972 the food supply objective persisted, as did the relief of population pressures, but new preoccupations were the need to provide economic and employment opportunities in the rural areas in an effort to stem the urban drift. Eventually, irrigators were permitted to form their own management committees for the day-to-day operation of the schemes. However, as we saw earlier, irrigation managers usually took full charge of the scheme. After independence a similar mix of objectives was formulated, but there was a more genuine emphasis on social development of the rural areas. In the words of Derude: 'increased production enhances rural prosperity and is not an end in itself' (Derude, 1983: 3). Nevertheless, there were striking similarities between some of the objectives formulated in 1983 and the policy statement of 1972 (Table 1.3).<sup>28</sup>

**Table 1.3: Stated 1972 policy objectives and corresponding objectives in 1983**

1972 (cited in Hughes, 1974: 186)	1983 (Derude, 1983: 3-4)
To provide locally grown food within the TTLs [Tribal Trust Lands, now known as communal areas] concerned and so avoid wasteful expenditure in connection with the movement of food into the area from outside.	{For supplementary schemes:] To serve as food security in grain-deficit areas of the country where a decent crop harvest is achievable once every 4-5 years. To reduce the inter-regional movement of grain in food-deficit areas where transport costs are exorbitant.
To provide employment opportunities within the TTLs for a large and growing population; to create real wealth on the irrigation schemes, a wealth which will overflow into surrounding areas.	To generate employment and raise the income levels of the rural poor through irrigation, agro-industries, trade and commerce, cottage industries and ancillary services.
To rationalise land use by making it unnecessary for tribesmen to open up huge areas of arable or dryland crop production in regions where this practice is inappropriate.	To serve as a vehicle for the introduction and adoption of new and improved techniques by the irrigators in such fields as conservation, crop rotation, livestock management, etc.

### Compromise and contradictions

Policy statements were often a result of political compromise, hence the large numbers of stated objectives.<sup>29</sup> One statement could easily contradict another. Two examples

of this lack of consistency are given here. Reynolds was suspicious about how the outcomes of the 1960 policy committee were implemented, in particular with the ambitious Middle Sabi development, which was to irrigate 100,000 acres (Reynolds 1969: 299–302). He concluded:

As with all the existing schemes in Rhodesia, settlement rather than development is to be the aim. . . . The failure of the earlier schemes, in . . . a developmental sense, is to be perpetuated without any attempt to match the abilities and rising aspirations of Africans. (p302)

Similarly, Hughes doubted the sincerity of the food supply objective in the 1972 policy statement by the Ministry of Internal Affairs. He saw how maximising production, and the corresponding technical and economic imperatives, had become the main guiding principle, with the resulting increase in managerial control by government and a stiff increase in water rates (Hughes, 1974: 213).

In the same manner, the stated objective in 1983 towards self-management of the schemes by the irrigators was never followed through to its full consequences (Rukuni, 1993a: 2) and sincerity of government to achieve this objective has been doubted (Makadho, 1994: 204). The dilemmas, between food security and maximising production, and between farmer participation and government control, made Rukuni observe that 'Smallholder irrigation in communal areas has always been a problematic policy area for subsequent Zimbabwean governments' (Rukuni, 1993b: 6–7; see also Rukuni, 1988a: 208).

It would appear, and this seems one important trend in irrigation development in Zimbabwe, that there is a lack of learning from past experiences. This is a weakness that seems to be institutionalised. This point was first made by Reynolds (1969: 299):

After thirty years of irrigation settlement schemes in Rhodesia little understanding of the co-efficients involved in the development of the schemes would appear to exist.

Chabanzara (1994: 196) and Makadho (1994) identified a lack of adequate data upon which policy decisions could be based. This is despite the many monitoring exercises that are being carried out on irrigation (such as by the Central Statistical Office, by the Ministry of Agriculture and by Agritex).

### **Institutional changes**

Institutions in smallholder irrigation represents an area that is little studied. However, the role of institutions in irrigation cannot be overemphasized. Rukuni is the only author to our knowledge who has written about this subject. Between 1932 and 1985 smallholder irrigation fell under eight different government agencies (Rukuni, 1984b: 17). In the colonial era smallholder irrigation, just like the rest of 'African

agriculture', fell under ministries and departments separate from 'commercial' agriculture, with the exception of the period 1964–1968 (when it fell under the Department of Conservation and Extension in the Ministry of Agriculture). These agencies included the Ministry of African Affairs, Internal Affairs Administration, the Department of Native Agriculture, the Ministry of Internal Affairs and the Department of Agricultural Development. This situation often created conflicts between the 'African' and 'European' agricultural sectors, and problems of coordination (see for a contemporary account of some problems: Alvord, n.d.: 36, 47).

The situation did not change with independence. By 1984 Rukuni reported that 'an important characteristic of smallholder irrigation in Zimbabwe is that management and agricultural extension are located in three different ministries' (1984b: 23). Rukuni thought this posed problems of coordination. Since 1984 the situation has not improved. Makadho (1990a) added the donor factor, which he suggested was a problem. He saw one of government's roles as 'controlling donor activities' (cf. Peacock, 1995).

## A MIX OF METHODS

The aim of this review chapter was to make an inventory of the main themes and issues raised in the literature regarding smallholder irrigation in Zimbabwe. If this chapter has shown one thing, it is that smallholder irrigation involves a host of different aspects, that are nevertheless interrelated: technical designs, agronomic potential, market opportunities, social organisation, management structure, farmer initiative, political tutelage, government priority and donor interference. Each of these aspects may have their specific weaknesses and inconsistencies. A weakness in one aspect may jeopardise the entire project of irrigation development. Successful irrigation development, then, requires a well-balanced set of technical, economic and organisational arrangements.

This review could logically be concluded by looking into the research agendas proposed in various publications (for example, Rukuni, 1985: 88; Zimbabwe, 1994: 33; IAP-WASAD, n.d.: 32; Makadho, 1994: 201; Chitsiko, 1995: 14), and by making a case for our own research priorities. This we will leave for the last chapter of this book. By way of concluding the present chapter, we will look into the methods of research best suited to capture the multi-faceted nature of smallholder irrigation. To us, method is more than a mere footnote; it lies at the heart of the strength and weaknesses of the existing body of literature.

This literature review has revealed that the work of Roder (1965) and Reynolds (1969) have been pioneering in many respects. These seminal studies have bequeathed thematic clues to many subsequent studies, either in the same areas or in new ones. We think that one of the reasons why both works have stood the test of time is because of the methodologies adopted.

Reynolds made a detailed case study of one irrigation scheme, Nyamaropa in Nyanga district, which allowed him to analyse in detail farmer perceptions and strategies related to irrigation and its management. To realize his aim of examining 'every aspect of life on the scheme and of the scheme's relations with the surrounding area' (Reynolds, 1969: preface), he adopted a method which combined a quantitative economic survey with qualitative anthropological research, 'so that the forces operating to further or hinder the development of the scheme may be identified and given their due weight' (p24).

Meanwhile, Roder had a wider scope. He analysed 'the development of nine small irrigation projects' (Roder, 1965: 5) in Mutare, Chimanimani and Chipinge districts, with a view to learn 'a few lessons . . . which may have relevance wherever irrigation settlement is weighed as a possible tool for achieving social change in an African environment' (p188). Roder maintained that 'much can be learnt about the processes of change by an examination of their evolution out of the traditional pre-conquest farming pattern'. He thought this could be achieved by a broad assessment, that was necessary 'because the creation of an irrigation project is a planning problem of technical, economic, social and political dimensions' (Roder, 1965: 6). Apart from surveys in the nine schemes, Roder did an extensive review of historical sources and analysed contemporary government policies. His 'broad assessment' was what we would nowadays call multidisciplinary research.

Both authors used a mix of methods and transcended disciplinary boundaries. Some 30 years later, Rukuni re-emphasised this point;

Irrigation is a multi-disciplinary subject. Evaluations and judgments from the viewpoint of a single discipline . . . are often inadequate, even biased (Rukuni, 1993a: 1)

Only a few later studies aimed at multi-disciplinarity, but it is questionable how many of these achieved the added value accruing from such an approach. Most studies that present original material are based on extensive surveys and have a resulting quantitative bias. Such studies tend to produce valuable assessments of certain phenomena, but often fail to analyse in any detail the mechanisms by which such phenomena occur or are sustained. The way in which questionnaires are 'commissioned' or 'administered' to 'respondents', often done by research assistants, has been criticised by Bourdillon and Madzudzo (1994: 19–20). The latter study adopts an anthropological approach, the only such study known to us after Reynolds.<sup>30</sup>

The two largest study projects on smallholder irrigation since independence, the Agritex/ODI/Wallingford and the UZ/Agritex/IFPRI projects, composed of researchers from a variety of disciplines, relied largely on findings from extensive socio-economic surveys, but included extensive water measurement programmes.<sup>31</sup> The combination of technical and socio-economic data allowed these studies to draw some important conclusions.

### **Capturing practice**

The chapters that follow in this book are also based on a combination of methods. They focus on specific aspects of irrigation practice. While the data were collected in various ways, all the chapters but one are based on information gathered, and perhaps we should better say, on knowledge gained, through prolonged stays in the respective schemes. Emphasis was first of all on observations, on establishing contacts and building more enduring social relationships with the people involved. Such an approach requires a modest attitude on the part of the researcher, and results in an appreciation of the problems faced by people in the research location. These include irrigators and their family members, labourers and officers. The different aspects addressed in the chapters, then, only partly reflect the researchers' preferences and disciplinary inclinations. They also reflect the realities encountered in the various localities where the studies were carried out. The authors of the case studies have different specialisations and include social scientists and engineers. In their various ways they attempt to cross disciplinary borders.

It follows that the collected data first of all are qualitative in nature and attempt to describe some practices and strategies deployed by the people concerned. This type of data is hardly available in the existing body of literature, and provides some insights into the goings-on in smallholder schemes which hitherto went unrecorded. Only after such an understanding was reached were attempts made to quantify certain phenomena and only where it was necessary for the argument. Often the inquiry was further extended to include a historical element.

Hence, in this book, primacy is given to qualitatively informed insights, which are backed up by quantitative data. This allows for analyses that go beyond mere assessments of certain states of affairs, and may answer questions such as why they exist and persist, and how these evolve. We believe that such a level of analysis is needed if we wish to venture into ways of overcoming the identified constraints in smallholder irrigation.

### **NOTES**

1. We wish to thank Dr Dayo Ogunmokun and Ms Mutsa Masiyandima of the Department of Soil Science and Agricultural Engineering, University of Zimbabwe, for their detailed comments and valuable suggestions. We also acknowledge suggestions from the authors of the other chapters in this book.
2. Compare for instance the following two statements made in 1993 and 1994 respectively: 'There exists a very good potential for further developments of smallholder irrigation schemes' (IAP/WASAD, n.d.: 25). 'The irrigation potential in Communal Lands is limited' (Rukuni and Makadho, 1994: 137).
3. It is unfortunate that the UZ/AGRITEX/IFPRI project was unable to include in their extensive survey those dambos where 'stream flow [was] apparent in the cultivated area' (Meinzen-Dick, 1993a: 11), due to the dubious legal status of such water use.

4. The Land Husbandry Act was apparently only enforced in Nyachowa (Roder, 1965: 184–85).
5. By the early 1970s this view still held currency (Hughes, 1974: 186). Hughes observed that ‘Official attitudes seem to have been based on the assumption that since the people in the area were being “given” irrigated plots they should be only too happy to pay water rents, and submit to control by the scheme management, in exchange for the right to use these plots’ (Hughes, 1974: 215). Still ‘at the time of independence in 1980 . . . management control was highly centralised . . . decisions were taken with little regard to what farmers felt’ (Pazvakambwa, 1988: 1).
6. ‘One of the most important limiting factors to agricultural and industrial expansion in Southern Rhodesia at present is the non-existence or small size of market outlets.’ (DNA, 1960 cited in Roder, 1965: 131). Cf. Alvord (n.d.: 39): ‘the need for a cash market for surplus native crops [is] an essential necessity. All over the country, Natives asked with wisdom, “What is the use of adopting better methods and producing more crops, when there is no market?”’
7. Studies conducted in 1972 and 1973 found that 2 acres were the minimum economic plot size (Paraiwa, 1972, 1973, cited in Rukuni, 1985: 87).
8. Of the 7 schemes studied by Hunt, Nyanyadzi was the only one considered economically viable. A survey conducted in 1951 found that the small-scale irrigation systems of commercial farmers were also ‘not being run efficiently’ (Turck and White, 1954: 45, 75).
9. The first ‘water rent’ was introduced by government in 1932 and amounted to 5 shillings per acre. It was doubled to ten shillings per acre in 1942 (Hughes, 1974, cited in Rukuni, 1988a: 203).
10. Tiffen and Harland (1990b:39) suggested that a maximum water fee might be equivalent to some 20 per cent of irrigated crop income (net total income), providing water supplies were reliable in all years.
11. By 1993, the fee of Z\$145 was equivalent to only 160 kg of maize, and by 1995 it had gone below 100 kg. By 1995, the fee probably represented 2 per cent or less of the net production value of the ‘average’ irrigator (if we were to apply the same criteria as Derude in 1983).
12. Peacock probably did not include in this figure capital costs and O and M (operation and maintenance) of government dams. Jansen estimates these costs to be Z\$23 million per year, of which only 3 million is recovered (1993: 11).
13. But for 1993, Rukuni (1993b: 3–4) concluded that the average O and M costs for Agritex and community schemes was Z\$667.30 per ha, implying a potential recovery of 22 per cent.
14. Water supplies to the irrigation sector have always been heavily subsidised. ‘Tariffs paid by commercial farmers in October 1983 ranged from Z\$1.60 to Z\$3.80 per 1000 m<sup>3</sup> whereas average national costs were at least Z\$8.52 per 1000 m<sup>3</sup>’ (GKW Consult, 1985: 108), and may have been as high as Z\$50–80 per 1000 m<sup>3</sup> (Derude, 1983:12). For 36 smallholder schemes, ‘costs for O and M alone . . . comes to Z\$14.87 per 1000 m<sup>3</sup>. These costs exclude capital redemption and interest rates’ (GKW Consult, 1985: 108). ‘If maintenance fees are levied on the basis of the amount of water used by the farmers, the average rate would be \$600 per ha per annum assuming a water requirement of

12,000 m<sup>3</sup> per ha per annum . . . At that level, few, if any, farmers could pay the levy' (Derude, 1983: 12). At the end of 1995 every smallholder scheme is charged the 'blend price' of water, which is supposed to cover all costs of storage and transport of water to the schemes (calculated on the basis of operation and maintenance (O and M) plus historic cost, capital redemption and interest charges), but the level of Z\$47 per 1000 m<sup>3</sup> (from 1 October 1994) is still less than the true cost of the water (Zimbabwe, 1994: 20). The cost of water in government dams differs per province and according to Jansen (1993: 12) ranges from Z\$157 to Z\$1000 per 1000 m<sup>3</sup> (see also Mitchell, 1990).

15. During those same years, maize marketed by smallholders was taxed.
16. Recent estimates show that storage works account for some 80 per cent or more of the total costs of developing smallholder irrigation (Peacock, 1995: 42; IFAD, 1994: 18–19).
17. Cost estimates, however, tend to vary widely (Rukuni, 1993b: 6). Typical estimates of the costs of a dam at 1993 prices ranged from Z\$137,000 to Z\$212,000 per ha (Peacock 1995: 42; IFAD, 1994: 18), that is, some US\$21,000–32,500. Construction costs of the scheme itself were taken at Z\$30,000 per ha (US\$ 4600).
18. There are recent calls to charge economic rates for the water based on the opportunity cost of this crucial resource (for example, Zimbabwe, 1994: 19). It would follow that only those volumes actually received by farmers would be charged as per specified requests; the true opportunity value of water! In such a scenario farmers should be able to claim rebates for delays, fluctuations and/or unreliability in supplies.
19. Chivizhe (1992: 3), however, observed that 'calling it a maintenance fee has resulted in wrangles between government and farmers in a drought year as the farmers argue that there was nothing to maintain if the system was not in use'.
20. This view contrasts starkly with recent findings by Meinzen-Dick *et al.* (1993: 18–19). They conclude that 'Female plottolders may have fewer non-farm activities and income sources, and thus depend more on irrigation'. They infer that if plots were to be allocated to 'literate women with large families and little dryland' intensive irrigated agriculture would result.
21. Roder did not comment on the place of women in the schemes he studied.
22. Probably one of the first of these few was Turck and White (1954), but this relates to small-scale irrigation for the commercial farming sector.
23. Even the handful of technical studies on water distribution did not come up with concrete proposals for improved designs; Pearce and Armstrong concluded that whereas 'in the past a design efficiency of 70 per cent has been used. . . . A field application efficiency of 55 per cent appears to be a feasible target' (Pearce and Armstrong, 1990: 18–19; cf. Watermeyer, 1990).
24. A revealing example is Derude's policy paper of 1983. Its 'format for irrigation project report' (appendix 9) contains no paragraph that gives attention to the design criteria used and design decisions made.
25. This approach was later institutionalised and well-defined procedures were laid down (Savva, n.d.).
26. But establishing crop water requirements is not that straightforward: these calculations, which used to be based on pan evaporation data, tended to over-estimate peak demand for wheat by as much as 30 per cent (Butlig and Makadho, n.d.: 11).



27. Apart from (future) beneficiaries and those potentially affected, those involved include officials at the local level, including the Chief, the Councillor and District level staff, DDF (District Development Fund), Department of Water Resources in the Ministry of Lands and Water Resources, Agritex in the Ministry of Agriculture, Ministry of Finance, National Economic Planning Committee, AFC (Agricultural Finance Corporation, administering the National Farm Irrigation Fund (NFIF), ARDA (Agricultural and Rural Development Authority), ZINWA (Zimbabwe National Water Authority), DR&SS (Department of Research and Specialist Services in the Ministry of Agriculture), a wide range of foreign NGOs (e.g. Lutheran World Federation, Christian Care, Coopibo, MS), and official donors and other organisations (EEC, DANIDA, ODA, DGIS, ADB, FAO, World Bank etc.).
28. Note that Derude's policy paper was never formally adopted by government.
29. For Mupawose, "The ideal policy for irrigation development is obviously one that will contribute most to food production, maximise economic returns, achieve an equitable distribution of productive resources and enhance the capability of the agricultural sector to minimise the adverse effects of season droughts' (Mupawose, 1984: A-12).
30. Harvey *et al.* (1987) report about another method, rapid rural appraisal, which was used by them in the GKW Hunting (1985) study (cf. Nyamapfene and Peacock, 1995).
31. The Agritex/ODI/Wallingford study in Nyanyadzi was mainly based on a survey of 56 farmers and 1 school. These were interviewed at three different times during 1986 and 1987 (Tiffen and Harland, 1990a: 9-10). The first questionnaire was 21 pages long, the second 18 and the third counted 13 pages (Tiffen, 1990). This research project was complemented by a detailed water measurement programme (Pearce and Lewis, 1988, Pearce and Armstrong, 1990). The UZ/Agritex/IFPRI survey was carried out in 1990-91. The sample consisted of 442 farmers across four types of irrigation systems, including 2 ARDA, 7 Agritex, 4 community, 4 garden irrigation systems, plus 2 dryland sites (Meinzen-Dick *et al.*, 1993: 4). The survey was complemented with an extensive water measurement programme which also included two comprehensive questionnaires (Makadho, 1993, 1994).



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