STATE OF THE ART OF IRRIGATION RESEARCH IN

ZIMBABWE

(annotated bibliography)

by

Mandivamba Rukuni*

Department of Land Management
Working Paper No. 7/84

Department of Land Management
University of Zimbabwe
P O Box MP 167
Mount Pleasant
HARARE
Zimbabwe, Africa

* Lecturer, Agricultural Economics

ACKNOWLEDGEMENTS

I am grateful to Professor Carl Eicher, Michigan State University, for his wisdom and assistance.

Views expressed here are personal. Comments are welcome.
1. INTRODUCTION

Frequent droughts and increasing land pressure are issues which have been central to irrigation development in Zimbabwe. Irrigation tradition in Zimbabwe goes back only as far as the beginning of the 20th Century. Over this century, government policies and development activities have changed. Some of these developments have been captured through literature and research studies. This paper is a review of such material available. The presentation is historical in perspective, covering the colonial era, the independence era and this has been synthesized to look at future trends and recommendations.

2. THE COLONIAL ERA: 1900 - 1979

Major differences exist in the way large-scale commercial and small-holder irrigation developed over the colonial period. It therefore makes more sense to review these sub-irrigation sectors separately.

2.1 Development of commercial irrigation during the colonial era

Watermeyer (1981) provides a concise synopsis of the history of commercial irrigation development. This historical account is supported by Wilson (1982). Watermeyer confirms that no significant irrigation development occurred until the period 1910 to 1920 which saw the first major scheme in Manicaland. Government, in form of the British South Africa Company, were in the forefront of development by completing Mazowe Dam in
1920, which irrigated a large area, eventually totalling 1900 ha after the dam wall was raised in 1960. Watermeyer supported by Wilson (1982) estimates that a total of 7000 ha were under irrigation by 1950. This development was largely dependent on river diversions without storage. The then Irrigation Department (1947) published its Annual Report which made strong recommendations that it should collect, as rapidly as possible, full data on water resources. This led to major hydrological surveys including the identification of Hunyani Poort (now Lake McIlwain) dam, with the potential of irrigating 3-4 000 acres. It was not until the 1950's that the farmers, supported by government, started building storage dams. By 1960, the irrigated area had increased to 25 000 ha.

In 1961, Kyle Dam (near Masvingo, then Fort Victoria) was completed to enable the irrigation of 26 500 ha at Triangle and Hippo Valley Estates in the south-eastern Lowveld. By the mid 1960's, the dominant tobacco export market had diminished due to the economic sanctions applied on the government. This led to a new policy of diversification, including intensive irrigation of crops like cotton, maize, groundnuts and wheat. Government supported farmers by introducing the revolving Farm Irrigation Fund, allowing farmers to borrow for 10 years at low interest rates. By 1968, the total area under irrigation was estimated at 60 000 ha.

Watermeyer's historical overview also shows that irrigation systems were mainly of the flood type until after the Second World War when sprinkler systems started appearing. After 1965, about 85% of the developed area was under the sprinkler
Extension and technical support for farmers

With the earlier efforts of commercial irrigation development, government published material to assist farmers design and construct their own schemes. Since this information was targeted for farmers and agricultural extension workers, coverage aimed at all major aspects of irrigation. Articles like Chegborne and Mec (1927), Hamilton Roberts (1931), Irrigation Division (1938) provided details on construction of dams, canals, problems of water management and methods of irrigation. The extension service, in the 1950's to 1970's through the then Department of Conservation and Extension (CONEX) continued to publish general technical information on irrigation for farmers. Some of these publications include Mackenzie (1948) with details on how to select the type of irrigation on the farm, Turck and White (1954 a) and b) showing simple ways of constructing small-scale farm units using homemade equipment and for supplementary irrigation and Department of Agriculture (1958) with instructions for taking soil samples for farm irrigation units. In the later years, farmers were installing more of the sprinkler systems and Turck, in later articles of 1956 and 1960 gives farmer guides to designing spray systems. CONEX eventually compiled a series of articles on irrigation, to produce an Irrigation Handbook. This handbook is continuously updated and its main contributor has been Watermeyer (1970) on soil-water relationships (1971 a) and b) on surface irrigation metrlication and 1980 on costing of water. Another key contributor to the handbook has been Pilditch (1970 a) on grid surveying, (1977 a) and b) on principles and design and management of sprinkler systems. Other contributors include
Technical research on irrigated crops

With the major drive toward irrigation development after 1965, one of the results was a lot of research into irrigated crops and resulting publications. Maize, cotton, wheat and groundnuts received considerable research under irrigated conditions. Work on maize varied from general agronomy, for instance Bembridge (1965) on supplementary irrigation and Davis (1976) comparing dryland and irrigated production of maize to finer aspects as with Wilson (1968 a) and b) on water relations and effects of stress, and Alvord (1969) maize responses to nitrogen fertilizer under irrigated conditions.

Wheat became an important irrigated crop as the government made the drive for self-sufficiency. A major publication was Edwards, Watermeyer and Fenner (1971), which was produced as the Technical Bulletin No.12 of the Rhodesia Agricultural Journal. The group of scientists contributed on aspects of soil-water relations, fertilization, pest and disease control and economic aspects.

Cotton became an important irrigated crop in the Lowveld. Experimental research on cotton was carried out at Sabi Valley Experimental Station. Cackett (1965) discusses various aspects of irrigated cotton in the Lowveld as a result of the experimental work. Metelerkamp and Cackett (1965) developed a system of water scheduling for cotton using weather data at Sabi Valley Experimental Station.
Published research work on other irrigated crops includes Metelerkamp (1972) and Davis (1971) on groundnuts; Cormack (1968) and Lonodale (1976) on sugar cane; Maitin (1967) on deciduous and citrus fruit; Clowes and Wilson (1974) on coffee; Turck (1960) on potatoes; Archibald (1974) on seed beans and Landsburg and Eddy (1965) on lucerne (alfalfa).

Technical research on soils and soil water
Published research on soils includes general assessment or irrigability as with Metelerkamp and Tompson (1967) and Tompson (1968). Other studies have been more specific as with Metelerkamp (1965) on efficiency of irrigating alluvial soils of the Sabi Valley; Pilditch (1970 b) on land planes for irrigation and Thompson (1972) on the re-use of regeneration waters and the reclamation of sodic soils in the south eastern Lowveld. Wilson and Metelerkamp (1974) and Metelerkamp (1978) are specific publications on irrigation scheduling of soil water for optimal crop growth.

Economics of commercial irrigation
Economic aspects of commercial irrigation seem to have received minor attention by researchers, as compared to technical research. Roberts (1969) analysed the economics of supplementary irrigation in Bindura. Besides the work by this economist, most other economic aspects were treated by some technical scientist to complement their work, for instance Turck and White (1954 b) on small-scale irrigation, Turck (1960), Watermeyer (1980) on water costs and Edwards et al (1971) on the economics of irrigated
2.2 The development of small-holder irrigation during the colonial era.

Roder (1965) gives the most comprehensive overview of the development of small-holder irrigation during the colonial era up to 1965. Subsequent to Roder's work, a number of major studies updated Roder's work but drawing heavily on Roder's work for the earlier history. In chronological order, these studies are, Reynolds (1969), Kelly (1972) Hughes (1974) and Rukuni (1984).

Roder, a geographer, in a major study of nine Sabi Valley Schemes in Manicaland, gives a background showing three major phases of development during the colonial era. The early schemes of the 1930's and 1940's (Phase One) were a result of government aim to reduce food deficits in concerned areas. However, by the 1950's (Phase Two) the government's aim in creating more schemes was to re-settle blacks removed from white areas under the Land Apportionment Act (1930). By the 1960s (Phase Three) government began questioning the validity of creating more small-holder schemes in black areas. Roder terms this the phase of economic concern. By the late 1970s up to the post-independence era, government renewed its commitment for further investment in small-holder irrigation. Rukuni (1984) terms this the irrigation for integrated rural development (Phase Four).

The phase of economic concern (Phase Two) started with the engagement of an economist, A.F. Hunt, in 1957 to look at the
economics of Manicaland schemes. The result was the Department of Native Economics and Marketing (1958) which found these schemes uneconomic and lacking markets. The Irrigation Policy Committee (1961) concluded that irrigation development in black areas was not effective as a means of accommodating increasing population. Their major recommendation was that government should concentrate on industrial development and commercial agriculture as these would absorb workers from rural areas. Investment in small-holder irrigation was only to be where it was found to be economic and locals accepted the responsibility for it.

Roder's work, however, revealed that these schemes benefited the irrigating families as well as the regional economy. A problem identified by Roder though, was that the cattle acquired by irrigators caused considerable environmental damage to surrounding range lands.

Reynolds (1969) is the most comprehensive case study analysis of a small-holder scheme. After living on Nyamaropa scheme, in Manicaland, for 14 months, Reynolds concluded that, contrary to government premise, farmers were quite competent and had developed sophisticated and effective management strategies to operate in a difficult environment of lack of transport, grazing, labour, government credit and secure tenure. Reynolds found problems with government in-action, and breakdown of communication between farmers and management. Management failed to appreciate farmer problems and operated on the basis that technical problems were the only valid problems.
In a review of development in Tribal Areas, Hughes (1974) reviewed irrigation development in Chapter 13 of the book. This review, dependent on literature review, gives a broader review of schemes throughout the country than the studies before it. Hughes made good use of the annual reports of the Central Statistical Office (1973 onwards) to provide useful facts and figures on the schemes and irrigating families. Hughes suggested further research on cost recovery, marketing, non-farm activities and farmer aspirations. As part of the continued interest in the economics of small-holder irrigation, the Secretary of the Ministry of Internal Affairs, in 1970, requested a survey investigating several schemes. An economist, Paraiwa, embarked on a series of economic analyses of these schemes. Paraiwa (1970 and 1971) showed that labour and marketing problems constrained the Midlands Province schemes. Paraiwa (1972 a) looked at a famine relief scheme in Matebelaland Province, Filabusi District and showed that the scheme was effective for famine relief but not in relieving land pressure problems. Paraiwa (1972 b) and 1973) looked at a scheme in Matibi 2 Communal Area (then Tribal Trust Land) to show that lack of tenure security resulted in high turnover of farmers; lack of markets led to subsistence oriented cropping patterns; the debt load was heavy resulting in expulsions and resignations; Paraiwa estimated that 2 acres were the minimum economic plot size. Subsequent work on the scheme Paraiwa (1974, 1975 and 1976) showed a steady increase in farmer incomes. Paraiwa concluded the scheme benefited the surrounding area.

During the colonial era, Kelly (1972) and Mudekunye (1980) were the only major socio-economic studies on large scale
estate irrigation. Kelly (1972) is a comparative study of white settler schemes at Mkwasine and a black one at Chisumbanje, both in the south eastern lowveld.

Kelly's recommendations out of his study were that with estate-cum-medium scale settler project producing sugar cane, like Mkwasine, the estate should control a minimum of 60\% to 80\% of the production to ensure a minimum guaranteed output for processing. With small-scale farms cum-nucleus estate schemes like Chisumbanje, these should be operated mainly by farmers with the estate controlling about 30\% production but still maintaining control of the farmers operations.

Mudekunye (1980) is probably the most comprehensive macro-level study on irrigation development in Zimbabwe. This study examined the role of the state and private enterprise in the development of the irrigated lowveld. Mudekunye analysed economic growth, income distribution (growth versus equity) for the period 1964 to 1978. One of the major findings of this study was proof that two assumptions which underlay public policy making were wrong viz (a) the peasant farmer and his system of production were a bottleneck to production and (b) that however production is organised, as long as growth occurs, the fruits of growth will spread to all groups of society. These findings are supported by Palmer Jones and Rukuni (1980). Mundenkunye found that state enterprise in the Lowveld was mainly in support of private enterprise and that in general output goals of food, raw materials for domestic use and export were met. However, he found that
1. Productivity of small farmers were in cases, higher than that of large producers. Mudekunye (1980) recommends a regional approach to development with regional targets of employment creation, access to services and increased linkages between sectors based on the small-scale mode of production.

3. DEVELOPMENT AFTER INDEPENDENCE IN 1980

Following Independence of Zimbabwe in 1980, research and policy focus has been mainly on small-holder irrigation. The Department of Rural Development (DERUDE) is in charge of small-holder irrigation. In 1983, a policy document was produced (DERUDE 1983) spelling out government policy and objectives. DERUDE maintains its commitment in building "supplementary" schemes in food deficit areas whilst going for "intensive" schemes where there is greater potential. Priority for irrigation farmers will be the landless and those with insufficient land. DERUDE policy is to involve farmers as much as possible in management of these schemes with provisions for ultimate devolution. Whilst small-holder irrigation is currently heavily subsidized by government, DERUDE hopes the farmers will gradually take over the costs. DERUDE's development strategy, given in the policy document, is that of giving priority to rehabilitation of existing schemes.

A number of studies on irrigation have emerged after Independence. Munzwa (1981) is a study of "comma-hectare" or "supplementary" schemes in Masvingo Province. Munzwa found
that these schemes were hampered by poor markets, roads and water supplies. However, he found that irrigation is becoming increasingly popular and that it was an agent of change on dryland farming due to increased use of purchased inputs like fertiliser. Muzwa found that "comma-hectare" schemes do not remove the need for dryland farming.

A number of commissioned studies also emerged mainly for project identification in the agricultural sector. These include FAO (1982), Duane and Negero (1983), USAID (1982) and Commission of Inquiry into the Agricultural Industry (1982). All these reports draw heavily on secondary sources of data and provide good background on potential for development.

Rukuni (1984 a) is so far probably the most comprehensive study on small-holder irrigation after independence. This study reviews the status and institutional settling of small-holder irrigation. It provides descriptive data on 53 small-holder schemes and detailed analysis of 3 representative case studies. The case studies of Nyanyadzi, Makonese, Sanyati, respectively represent 3 broad types of older "intensive" DERUDE schemes, younger type "supplementary" DERUDE schemes and those of the Agricultural and Rural Development Authority. Rukuni found that the large older DERUDE schemes had better services and bigger plots than the younger ones. Management of schemes was less effective, (Rukuni 1984 b), since DERUDE still relies heavily on extension staff from the Department of Agricultural Technical and Extension Services (AGRITEX). The push for cost recovery by farmers is hampered by poor technical efficiency
fo schemes. Credit administration was poor due to delays. Marketing and transport are still major problems of small-holder irrigation.

A proposed African Regional Symposium on Small-holder Irrigation will be held at the University of Zimbabwe, 5-7 September, 1984. This has prompted a number of Zimbabwean researchers and practitioners to prepare papers for the symposium. Coverage of these papers is fairly wide; Hungwe (1984) on soil irrigability; Rukuni (1982 c and d) on cropping patterns and productivity, farmer resources and use; Pazvakarambwa (1984 a and b) on management aspects; Stevens (1984) on power sources for water supplies; Ball (1984) on efficient use of risk waters and Makadho (1984) on factors affecting viability of small-holder schemes. Thorough review of these papers will only be possible after final drafts are produced as part of the proceedings of the Symposium.

4. RESEARCH AGENDA FOR THE LATE 1980 AND 1990s

Whilst a number of areas of research can be identified for further research, it is essential to develop some criteria for determining priorities. Irrigation is there to stay and be developed in Zimbabwe and the main reason for this relates to food security. Whilst the Independence government has talked about priority to small-holder farmers, in practice planners have found the reviewed problems and costs to be high. To guide policy and planners, a lot more research is needed in the area of Economics of Irrigated Food Production. Since food is the key problem, research should reveal how effectively food can be produced
under irrigation. This should provide guidelines for emphasis to be given to other areas of research which include water management, marketing and pricing, cost recovery, adoption of technology and farmer devolution.