New water policy, irrigation management transfer and smallholding irrigation schemes in South Africa: institutional challenges

Perret, S.R.

Working paper: 2001-15

Department of Agricultural Economics,

Extension and Rural Development

University of Pretoria

Pretoria, 0002

South Africa

New water policy, irrigation management transfer and smallholding irrigation schemes in South Africa: institutional challenges.

Author: Sylvain R. Perret, Dr.

Affiliation: CIRAD and University of Pretoria, Department of Agricultural Economics

Details: Postal address: Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, 0002 Pretoria – SA.

Tel. + 27 12 420 5021

Fax. +27 12 420 3247

e.mail: sperret@nsnper1.up.ac.za

Paper proposed at the FAO e.mail Conference on Irrigation Management Transfer, Sept/Oct. 2001, the paper is also available on the Conference website at:
http://www.fao.org./landandwater/aglw/waterinstitutions/default.htm

Introduction

What makes South Africa an interesting case of IMT is that it takes place along with the implementation of a new water policy. Equally challenging is the fact that IMT involves a series of very different situations, from commercial and exporting large-scale irrigation schemes, to smallholding developing, and subsistence-based irrigation schemes.

This paper briefly reviews the situation of smallholding irrigation schemes –SIS- in previously disadvantaged rural areas of South Africa. It then analyses the implication of the new National Water Act of 1998 on those schemes, with regard to the IMT process. An analysis of water rights related issues is proposed. It highlights a number of contradictions, uncertainties and possible threats which may hinder further development, and sustainable IMT in SIS.

Since 1994, the South African Government has undertaken massive reforms aiming at addressing rural poverty and inequalities inherited from the past apartheid regime. Amongst other programmes, it adopted an ambitious new water legislation, which promotes equity, sustainabilitity, representativity and efficiency through water management decentralisation, new local and regional institutions, water users' registration and licensing, and the emergence of water rights' markets.

At the same time, it adopted liberalism as economic and developmental guideline. Direct consequences are: State withdrawal from its former commitments and controls, liberalisation of markets, decentralisation, transfer of competencies towards local management and decision structures. IMT partakes to this process. All this also generates a major dilemma for a government under budget constraints and social pressure, i.e. matching a social, right-based, gap-filling and developmental approach with a productivity, economic efficiency approach. Such an issue is reflected in the tricky circumstances currently facing SIS and the IMT process in South Africa.

History

At present, South Africa has an estimated 1.3 million ha of land under irrigation for both commercial and subsistence agriculture. Irrigation was introduced to South Africa soon after the arrival of European settlers, although really developing from 1912 onwards. Bruwer & Van Heerden (1995), then Van Averbeke et al. (1998) described thoroughly this evolution, stressing especially on the early gap that existed between white and black irrigation.

In the former Bantustans or Native Areas, minor irrigation developments occurred before 1950. Most irrigation schemes were started after the publication of the report from the so-called Tomlinson Commission on the socio-economic development of the Bantustans. This report and the implementation of some of its recommendations had a major effect on settlements, land use patterns and irrigation development in black rural areas. Its effects are still very noticeable today. Based on information collected at existing schemes, the Commission suggested that irrigated holdings of 1.3 to 1.7 ha were adequate to "*provide a family with a living that would satisfy them, whereby the whole family would work on the holding*". It also proposed that "*All schemes should be placed under proper control and supervision, with uniform regulations as regards water rates, credit facilities and conditions of settlement…*"

Preliminary surveys estimated that the irrigation potential of the Bantustans was about 54000 ha, sufficient to settle 36000 families. Schemes developed during the late 1950s et 1960s followed most of these recommendations. They would employ a relatively inexpensive design (furrows would convey water from a weir or a dam), and aim at a family's subsistence through surface irrigation.

FIRST ISSUE FOR IMT: THE ORIGINAL DESIGN AND AIM OF MOST SIS WAS SUBSISTENCE-ORIENTED

During the 1970s, political and administrative independence of the Bantustans was encouraged, resulting in the central government's withdrawal, and homelands' administrations taking-over (homelands' parastatal corporations were created).

Current situation and recent developments

As described in table 1, history and past policies result in different types of irrigation schemes in SA.

SIS in South Africa comprise approximately 46000 to 47500 ha (Bembridge, 2000; NP-DAE, 2000) as former Bantustan schemes, and about 50000 ha as garden schemes and food plots. Almost half of them are located in the Northern Province (171 schemes representing 20000 to 22000 ha). It is estimated that two third of South Africa's SIS are dedicated to food plots, with subsistence purposes, and that 200000 to 230000 rural black people are dependant at least partially for a livelihood from such schemes.

Bembridge (1996, 2000) stated that the performance and economic success of SIS in South Africa have been very poor, and "*fall far short of the expectations of planners, politicians, development agencies and the participants themselves, and that despite huge investments*". However, one must acknowledge that such economic success has never been the clear and unique objective underlying the past and present development policies for SIS. Past policy promoted subsistence-based activities by farmers, who were virtually "*spoon-fed"* by parastatal agricultural corporations (Shah & Van Koppen, 1999).

Table 1. A typology of the existing irrigation schemes in SA

Type of scheme	Private schemes	Irrigation boards schemes	White settlement schemes	Bantustan schemes	Food plots, community garden schemes…
Period of development	1650 onwards	1912 onwards	1930s-1940s	1950s-1980s	-
Number	-	300		250	-
Total area	450 000 ha	400 000 ha	350 000 ha	40 to 50 000 ha	50 000 ha (est.)
Scheme size (range)	2 to 10000 ha	20 to 60000 ha	40 to 120 000 ha	30 to 2000 ha	1 to 30 ha
Average farm size per beneficiary	-	-	40ha	Initially 1.3-1.7ha, sometimes more	From several m3 to less than 1 ha
Scheme ownership	Private	Private	Government	Government	Communities, CBOs…
Land tenure	Private	Private	Private	Mostly Communal	Communal
Scheme development and maintenance	Private investment and running costs	Capital = 2/3 private + 1/3 Government	Government	Government	NGOs, CBOs, various donors, Departments, communities
Current processes and issues	Registration and Licensing	Registration as WUAs Some facing financial problems	Most of them turning into boards, then WUAs Some being re-allocated to black emerging farmers Most facing	Rehabilitation and management transfer processes Forming WUAs Land tenure	Uncertainty on sustainable management (costs recovery)

			financial problems	Uncertainty on sustainable management (costs recovery)	

Sources: IPTRID-FAO, 2000; Vaughan, 1997; Bembridge; 2000.

In addition, and conversely to Tomlinson Commission report's assumption, irrigation smallholding families diversified their activities and livelihood systems, especially with massive out-migration of male labour (cities, mines, industries). Eventually, women and pensioners' headed households remained in the homesteads and scheme holdings, carrying out extensive food crop and livestock farming, with weak or unclear property rights on land and water resources.

SECOND ISSUE FOR IMT: LITTLE PARTICIPATION BY IRRIGATORS FROM THE BEGINNING, NO LOCAL ORGANISATION, MOST LAND RIGHTS ARE GRANTED TO MEN, WHILE WOMEN ARE THE ACTUAL IRRIGATORS

It is worth noticing the gradual shift in the underlying paradigm of SIS in South Africa, still with neither a clear economic objective, the means to achieve it, nor actual people's participation. Most schemes were built up for social and food security purposes during the apartheid era, in the early 1960s. From the early 1980s, the management agencies (corporations) were facing such financial and social problems that they encourage farmers to make some cash profit, in order for them to pay back production costs and services. However, food security remained the major objective, and crops and production patterns remained the same, along with weak market opportunities and poor agribusiness environment. At the same time, due to infrastructure degradation, consultants were hired to set up rehabilitation plans. Hence, the more sophisticated technologies (pumps, sprinkler irrigation) that were introduced in certain schemes, and which require even higher capital, and operation and maintenance costs.

THIRD ISSUE FOR IMT: HEAVY OPERATION AND MAINTENANCE COSTS IN MOST SCHEMES, BUT STILL MOST IRRIGATORS ARE SUBSISTENCE FARMERS, WEAK AGRIBUSINESS. ENVIRONMENT

Following (and in certain instances before) the dismantlement of apartheid, management agencies were liquidated, and government gradually withdrew from its past functions in SIS (service, technical advise and extension, training).

FOURTH ISSUE FOR IMT: THE BRUTAL WITHDRAWAL OF ANY SUPPORT IN MOST SCHEMES

In the Northern Province, it is acknowledge that most of the 171 SIS are moribund and have been inactive for many years (NP-DAE, 2000). Several causes are touched on, i.e. infrastructure deficiencies emanating from inappropriate planning and design, and/or poor operational and management set-up, inadequate technical know-how and capacity on the part of the beneficiaries as well the government assigned extension

officers, lack of people's involvement and participation, inadequate institutional structures, inappropriate land tenure arrangements. In the Eastern Cape and Kwazulu-Natal, most schemes are also facing major infrastructural and institutional problems, along with local political power games that characterise those schemes since the outset, and that hinder effective problem solving.

From the late 1990', provincial governments set up rehabilitation and management transfer programmes (ECRA, 2001; NP-DAE, 1999), yet with a huge diversity of approach across the country. For provincial departments, the background idea is undoubtedly to curtail the heavy financial burden of SIS, most of them not being part of the commercial stream of the agricultural sector. On the other hand, departments would like to promote the emergence of small-scale commercial farmers (which is also the motto of the National Department of Agriculture), along with maintaining the community subsistence function of the schemes.

Still, all rehabilitation and reactivation efforts face the same dilemma, i.e. the match between a social and an economic approach to these SIS.

The National Water Act of 1998 provided an opportunity to re-think the paradigm underlying SIS development in South Africa, and to develop new institutions.

New institutions for water management

With the dismantlement of former dispensations and the adoption of a new democratic constitution, South Africa also adopted a new water policy, which culminated with the acceptance of a new National Water Act –NWA (Act 36 of 1998). The new act breaks drastically with the previous water laws in the sense that some past key concepts have been discarded. These include the individual right to use water for riparian users. Water is now considered as a common asset. The NWA specifies that government, as the public trustee of the nation's water resources, must act in the public trust to ensure that water is "*protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons*" (DWAF, 1999). The right to use water will be granted to users, most of them have to be registered and licensed, and they should pay for this right. Also, the core concept of water management under the new dispensation is decentralization. Finally, protective measures are meant to secure water allocation for ecological, and basic human needs and development purposes (concept of "Reserve", and "Schedule 1" use, see below).

Social development, economic growth, ecological integrity and equal access to water remain key objectives of the new water resource management dispensation. The Act distinguishes national areas of water management from regional and local ones. New management entities (Catchment Management Agencies and Water Users' Associations) will be established in order to achieve the purposes of the Act. These institutions are to be implemented at regional and local level respectively, emphasising a largely decentralized and participatory approach to water resource management.

The core purpose of Catchment Management Agencies (CMAs) is to ensure the sustainable use of water resources in their areas of operation, in line with the purpose of the Act, with the National Water Resource strategy, and with a Catchment Management Strategy. Nineteen Water Management Areas have been demarcated countrywide. Several pilot CMAs are currently established, with facilitation and supervision activities by regional offices of the Department of Water Affairs and Forestry (DWAF) and contracted consultants.

The CMAs provide the second tier of the water management structure set up by the Act and they operate within the framework provided by the Minister of Water Affairs and Forestry. Local implementation of a catchment management strategy will be carried through institutions to which the CMA may delegate functions, e.g. Water Users' Associations (WUAs).

Water Users Associations (WUAs) potentially form the third tier of water management and will operate at a local level. These WUAs are in effect co-operative associations of individual water users who wish to undertake water-related activities for their mutual benefit. The role of the WUA is to enable a community to pool financial and human resources to more effectively carry out water related activities. Irrigation on a commercial or subsistence scale is one of those activities.

Table 2 describes the different water use rights that are determined by the NWA.

At rural community and smallholding farming levels, all individual users are authorized to take water for "reasonable domestic use, gardens and stock watering" (though not for commercial purposes) without registration, licensing or payment, as stipulated in Schedule 1 of the Act.

The Act however also stipulates that farmers and rural communities should form WUAs, especially in smallholding irrigation schemes. They must apply for a licence, which will determine their collective rights and duties on the water resource. It may also concern the community as a whole when a WUA is to manage water beyond irrigation purposes. DWAF has launched a massive users' registration campaign. It will be followed by a verification stage, with satellite and aerial images, as a basis for management and water fees recovery.

Issues related to water rights

The Act proposes a set of possible water rights (see table 2). It remains unclear as to which category of water rights will apply to small-scale irrigation farms.

Under the NWA, only WUAs may apply for a licence and may be granted the right to use water under specified conditions. Failure to become a member would limit individuals' water use to a Schedule 1 use. Individually (at household level), rural people are automatically granted a free and unregistered right to "reasonably" use water for irrigation (Schedule 1). The NWA urges rural communities and smallholding irrigation farmers to form WUAs, which will be registered, licensed and charged (water fees). Moreover, WUAs are likely to impose water management rules and schedules, which are often sources of conflicts

and discontentment in farmers' communities. A question is pending as to what would be the incentive for a farmer to get into the hassles of a WUA, while they are allowed to use water otherwise. DWAF argues that a licence might give room for intensification and commercialisation, through increased water allocation (reviewed licence), then consumption. Such a process is unfortunately not only depending on water. The economic history of irrigation development in South Africa shows that success or failure of irrigation development in the past is related to marketing potential of agricultural products and the level of profitability of farming (Backeberg & Groenewald, 1995).

Table 2. An overview of water use rights, as determined by the National Water Act of 1998.

Water use right	Description
Licence	A licence is a legal entitlement to use water, granted for a period of 40 years maximum (users must be registered). Its terms and conditions may be reviewed and amended at a period listed in the licence, which will not be more than 5 years. It does not guarantee water availability or quality to the licensed users. It may be surrendered, withdrawn, transferred totally or partly, temporarily or permanently. It may be inherited by a successor-in-title to a licensed water user. Transfer of licences is possible a form of trading of water use (water rights' market). A use is regulated by a licence when there is a high risk of unacceptable impact if not controlled (overuse, degradation…). A reserve must be determined for a water resource before any licence can be issued. DWAF may call for compulsory licensing of water use (i.e. decide on licence allocation, terms and conditions for all prospective users) in stressed resources where there may be problems experienced from over-utilisation, competing water users, or very inequitable allocation. Such calls for compulsory licensing will apply to all water users and rights, including general authorisations and existing lawful uses. An allocation schedule will be proposed in such instances.
General Authorization	A general authorisation is an authorisation to use water without a licence, with certain limits and conditions, and it is valid for 3 to 5 years. It may be reviewed at intervals of not less than 2 years. It only applies to new water use that took place after October 1999, when the Act was fully promulgated. It applies to any water use anywhere in the country, unless in areas that are specifically excluded from it. It may also apply to a particular water resource. It is generally issued in an area with relatively sufficient water. It allows certain water use of small or insignificant impacts on a water resource (i.e. limited abstraction and storage, irrigation with waste water, discharge of waste water…) General authorisation users are usually not required to apply for licences (except in water stressed situations), but they must be registered in most cases.
Existing lawful use	Existing lawful uses correspond to authorisation that were granted from October 1996 to September 1998, just before the application of the National Water Act. Existing lawful users are usually not required to apply for licences (except in water stressed situations), but they must be registered
Schedule 1	Schedule 1 uses of water have minimal or insignificant impact on water resources. They include amongst other uses "reasonable" garden watering and rainwater storage. Schedule 1 users are not required to register, nor to apply for licences.
Reserve	The Reserve is the only right to water in law. It is not a water use right per se. It consists of 2 parts, i.e. the ecological reserve and the basic human needs reserve, which includes water for drinking, food preparation and personal hygien. It specifies the quantity and quality of water that must be present in a given water resource, according to its hydrological, ecological and demographic features. All other water use rights are subjects to the requirements of the Reserve.

Most SIS are currently not using fully their water rights (low consumption) (Bembridge, 2000). Besides, all operators recognise that there is little additional water that can be tapped in most basins. Furthermore, the Act itself bears a implicit willingness to limit the agricultural share of the national water consumption (Hamann & O'Riordan, 2000).

The loss (withdrawal or transfer) of a licence would automatically transform a co-operative effort into scattered individual uses, which would fall under Schedule 1 definition. Although contradictory with the current policy that aims at the emergence of commercial smallholding farming systems through irrigation, such a loss actually might not be a problem at farm level, as most small-scale farmers are currently using water very "reasonably", meaning for crops grown in limited areas, meant to self consumption, even if plots are part of irrigation schemes (Bembridge, 2000). IPTRID (2000) considers that most small-scale irrigation abstraction is classified or will be classified under Schedule 1. Schreiner et al. (2000) considers that small-scale farmers cultivating less than 2ha are not included in the registration campaign, because expectedly, they will not be obliged to pay, even if they market substantive parts of their crops.

All these aspects, along with the emergence or the increasing demand of non-agricultural users (especially mines) put pressure on community users, and especially SIS, and paves the way to water rights transfer from communities to other sectors (see below).

A valid argument for WUAs establishment in a community setting is the need for sound local water management, in a context of resource scarcity and competing uses, with the multi-facet objective of supporting (1) the existing subsistence-oriented farming systems (food security), (2) the emergence of commercial farmers using water-conservation technologies, (3) the co-ordinated access to water by the whole community, and finally (4) the protection of the community's water rights. This should be accompanied by a series of measures and incentives, so that other key functions could be also carried out by the WUA (especially on markets' access, i.e. inputs, credit, products, services and information market). Also, schemes in which food plots are predominant should be dealt with separately (Schedule 1).

Most WUAs should currently be registered. Most of the former white irrigation boards are registered and have submitted a proposal to form a WUA. The situation is however very diverse. In certain catchment management areas, little has been done. Nation-wide, the establishment of WUAs in small-scale government-owned irrigation schemes is very slow.

Possible emergence of a water-rights market: issues

It has been argued by a number of authors (Armitage, 1999; Louw and Van Schalkwyk, 2000) that the new Water Act provides the framework for water markets in South Africa. Although stated vaguely the water legislation makes provision for water rights trading as an option for water allocation. The Act is however, very unclear with regard to the legal transfer of water use licences.

Sectorial water rights trading already exist between commercial irrigation farmers (Armitage et al., 1999) and prove efficient in certain instances. It must be emphasised that DWAF played an important role in the successful cases, assuring transparency, supervising and recording transactions.

All large users (mines, industries, cities…) are registered. Certain mines plan to expand their activities and their need for water. Some are investigating the possibility to buy water rights from SIS (DPR, 2000), while others are already proactive, negotiating with smallholding irrigation schemes and communities to create water "multi-users" associations, in order to increase their water supply (Rouzere, 2001). Negotiations have already taken place in different areas of the Northern Province, in the water stressed basin of the Olifants river, and under close monitoring by DWAF and the provincial Department of Agriculture (NP-DAE). The background ideas are that most SIS are not currently using their entire water rights, in terms of allocated quantity, while newly settled mines or mines expanding their activities are in dire need of water. Besides, mines provide most job opportunities in the areas.

The purpose of this discussion is not to challenge the idea of water rights trading, nor to criticize the specific transfer processes that are currently taking place. A series of issues must however be highlighted, with regards to those processes.

- Rural communities and smallholding irrigation farmers are often not even aware of the on-going processes, i.e. registration, WUAs and CMAs establishment, IMT… (Stimie et al., 2000; Rouzere, 2001).
- Mines are very powerful and proactive. Some have submitted proposals to establish multi-sectorial WUAs. Such institutions are not likely to accompany the IMT process, nor to promote commercial-oriented production in the SIS, or to co-ordinate water management at scheme level, which are conditions to the development of SIS. The question remains as to what is the role given to communities in such processes, which are heavily top-down oriented, and looks very similar to the former institutional and development-support arrangements (before 1994).
- Before any final decision being made, mines are already busy building up the necessary infrastructures for supplying water to their plants. They investigate the possibility to co-fund and organise water supply to the communities as well. On the short term, communities will obviously be more interested in domestic water supply than in securing their irrigation water rights.
- Mines provide most male job opportunities in the area, while conversely, 70% of small scale irrigation farmers are women, assuring food supply and some cash income to rural families. Socio-economic aspects (poverty alleviation, food security, gender equity) should be taken into account and counterbalance pure economic ones.
- Finally, there is a lack of foresight on the close future (5 years). According to the increasing water demand by mines, and in the event that DWAF could not increase the water resource availability

in the area (upgrading or building dams), water rights transfers are likely to be extended further. The prospects for small-scale irrigation development will then just be abandoned.

Such situations highlights the difficulty to implement a multi-objective water policy in a context of competing uses, and of extremely different users in terms of economic performance and power.

Links between water rights and land rights: issues

The situation on land rights in SIS is problematic, with regard to the new water management context.

The land reform program that is currently implemented, and especially its land tenure component, is not evolving as quickly as the water rights reform (Van Zyl et al., 1996; Lahiff, 1999; Kirsten et al., 2000).

Most SIS areas form part of former homelands, and are State-owned land (communal land). Plots are held under a "permission to occupy" certificate. PTOs used to be granted mostly to male farmers by traditional authorities, with control, monitoring and record by the local magistrate and/or local offices of departments of Agriculture. A PTO gives exclusive individual life-time usufructuary rights to the land but do not allow for sale, mortgage, lease or subdivision. Even though falling far short of private ownership, such system appears to be a relatively secure form of tenure (Lahiff, 1999; Merle et al., 2000).

PTO certificates remain the main visible claim to the land, even though they are technically obsolete since 1991 (Abolition of Racially-based Land Measures Act, 1991). Plots' subdivision, hiring or even sale are now observed, as emerging practices by SIS farmers (Merle et al., 2000). The PTO system has gradually shifted from a real land entitlement to a convention, as records are no longer kept on allocation or tenure in most rural areas. SIS farmers, and especially women, actually do not exactly know what are their current land rights. At the same time, water rights are shifting from convention to entitlement (licensing).

In SIS, land rights transactions (casual hiring, lease or sale) remain highly dependant on the water rights attached to that land, especially in terms of land pricing. In most SIS, emerging commercial farmers might be interested in taking over both rights from subsistence farmers. The current uncertainty is a hindrance to SIS development.

Conclusion

The National Water Act (1998) of South Africa is internationally recognised as the most promising legal framework to adequately address the countries' challenges in water management.

The present discussion paper analyses its possible or observed implementation features in smallholding irrigation schemes, and highlights a series of issues.

Although highly commendable, the Act mixes up several objectives (i.e. resource protection, social equity and development, economic efficiency) that show contradictory in a context of resource scarcity, severe backlogs in rural areas, competing users, needs for economic performance and job creation, etc. This

creates a strong dilemma, which is reflected on the different streams of thoughts inside the National Department of Water Affairs and Forestry -DWAF, and on the implementation features. The overall task seems challenging if balance has to be obtained between at least maintaining the current production capacity of commercial agriculture, modernising developing agriculture and creating new off-farm employment opportunities (and added value) to reduce poverty in rural areas (Backeberg & Odendaal, 1998).

On a practical implementation basis, the National Water Act also remains unclear about the implementation features on several key issues (e.g. water rights and local institutions, water market). This forces DWAF to operate on a case basis, which is time and money consuming. Lack of manpower and competencies also favours the resort to external consultants, who are not always liable for their recommendations and advice. Such an approach seems however inescapable at the moment.

The Act reveals difficult and slow to implement in the realm of smallholding irrigation farming, due to a number of uncertainties and contradictions on the objectives and prospects of SIS. A key issue will probably consists in setting clearer objectives to SIS, on an individual case basis. The ones with good potential for sustainable irrigated productive activities should have clear, irrigation-oriented, and protected water rights, along with irrigation WUA for sound local water management. Then, water rights and their management might become levers to alleviate poverty and promote development locally.

Lack of existing farmers' organisation is also a strong hindrance to local institutionalisation and to the all IMT process.

South Africa's new water policy faces a tricky transition period. It has to deal with the legacy of apartheid and the heavy history of SIS. If well managed, the NWA forms a powerful set of tools to achieve equity, poverty alleviation, and development in rural areas. Early experiences show that sound, cautious and State-controlled implementation remains necessary.

References

Armitage, R.M. (1999). *An economic analysis of surface irrigation water rights transfers in selected areas of South Africa*. WRC Report no: 870/11/99, Pretoria, SA.

Armitage, R.M., Nieuwoudt, W.L., Backeberg, G.R. (1999) Establishing tradable water rights: case studies of two irrigation districts in South Africa. *Water SA*, 25 (3) : 301-310.

Backeberg, G.R. & Groenewald, J.A. (1995) Lessons from the economic history of irrigation development for smallholder settlement in South Africa. *Agrekon*, 34 (4): 167-171.

Backeberg, G.R. & Odendaal, P.E. (1998) Water for agriculture: a future perspective. *In: Proceedings of the 39th Ordinary General Meeting of the Fertilizer Society of South Africa, 24 april 1998, Sun City, SA*, pp 49-61.

Bembridge, T.J. (1996) *Small-scale farmer irrigation schemes in South Africa. In: Backeberg et al. Policy proposal for irrigated agriculture in South Africa.* WRC Report, Pretoria, SA.

Bembridge, T.J. (2000) *Guidelines for rehabilitation of small-scale farmer irrigation schemes in South Africa*. WRC Report num. 891/1/00, Pretoria, SA.

Bruwer, J.J. & van Heerden, P.S. (1995) Spotlights on irrigation development in the RSA: the past, present and future. *In: Proceedings of the Southern African Irrigation Symposium, Durban, 4-6 June 1991*. WRC report num. TT 71/95, pp3-10.

Department of Water Affairs and Forestry (1999 & 2000). *National Water Act News* (various information pamphlets on the principles and implementation of the new Water Act. http://www-dwaf.pwv.gov.za)

Department of Water Affairs and Forestry (2000). *Development of a Generic Framework for Catchment Management Strategy*. Directorate Catchment Management, Pretoria, SA.

DPR (2000) Meeting the water needs of economic development in the Phalaborwa SDI. Investigation of possible new approaches to water re-allocation in the Letaba catchment. Consultancy report, feb. 2000. Development Planning & Research, Wits, SA.

Eastern Cape Restructuring Authority (2001) *Transformation of the Eastern Cape agricultural corporations and irrigation schemes.* ECRA Report, march 2001, Bisho, SA. 16p.

Hamann, R. & O'Riordan, T. (2000). Resource management in South Africa. *South African Geographical Journal*, 82 (2), 23-34.

IPTRID-FAO (2000). *Affordable irrigation technologies for smallholders: opportunities for technology adaptation and capacity building (South Africa).* Report, IPTRID Secretariat / FAO Rome, 34p.

Kirsten, J.F., Perret, S. & Van Zyl, J. (2000) Land reform and the new water management context in South Africa: principles, progress and issues. *Seminar of the Natural Resources Management Cluster and Land Policy Thematic Group, The World Bank, Washington DC. 27 September 2000,* 23p.

Lahiff, E.P. (1999) *Land tenure on the Arabie-Olifants irrigation scheme*. IWMI working paper 2, Colombo, Sri Lanka.

Louw, D. and H. van Schalkwyk (2000). *Water markets an alternative for central water allocation*. Paper prepared for the AEASA annual conference, Sun City, South Africa 28-29 September 2000.

Merle, S., Oudot, S. & Perret, S. (2000). *Technical and socio-economic circumstances of family farming systems in small-scale irrigation schemes of South Africa (Northern Province).* PCSI report, CIRAD-Tera, num. 79/00, Pretoria, SA.

Northern Province Department of Agriculture and Environment (1999) *Mega Business Plan for Water Care Program in the Northern Province*. NP-DAE report, Pietersburg, SA. 54p.

Northern Province Department of Agriculture and Environment (2000) *Overview of irrigation water in the Northern Province*. NP-DAE report, Pietersburg, SA,17p.

Rouzère, H. (2001) *L'établissement d'agences de bassin en Afrique du Sud, principes et implementation*. Rapport CIRAD/CNEARC, Montpellier, France. (forthcoming)

Schreiner, B., van Koppen, B. & Khumbane, T. (2000) *From bucket to basin, water management for poverty eradication and gender equity: a new paradigm*. DWAF-IWMI working paper, Pretoria, SA.

Shah, T. & Van Koppen, B. (1999) *Water management research issues in Northern Province, South Africa: field notes from Arabie irrigation scheme in Olifants River*. IWMI report, Pretoria, SA. 20p.

Stimie, C., Richters, E., Thompson, H. & Perret, S. (2001). *Hydro-institutional mapping in the Steelport River basin*, South Africa. IWMI working paper 17, Pretoria, SA.

Van Averbeke, W., M'Marete, C.K., Igodan, C.O. & Belete, A. (1998) *An investigation into food-plot production at irrigation schemes in central Eastern Cape*. WRC Report num. 719/1/98. Pretoria, SA.

Van Zyl, J., Kirsten, J.F. and Binswanger, H.P. (eds.) (1996). *Agricultural land reform in South Africa: Policies, Markets and Mechanisms*. Oxford University Press, Cape Town.

Vaughan, A. (1997) *Irrigation development. Current realities, new policies, and future possibilities for positive impacts on rural poverty*. Institute for Social and Economic Research, a Poverty and Inequality Study report, Pretoria, SA.