Mlilo P, Mhlanga BFN and Senzanje A. 2008. Emerging Issues in Water Resources Management in Swaziland. Presentation at Governing Shared Resources: Connecting Local Experience to Global Challenges, 12th Biennial Conference of the International Association for the Study of the Commons, Cheltenham, UK, July 2008.

Emerging Issues in Water Resources Management in Swaziland

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Abstract:

Water is central to the economy of Swaziland as it contributes significantly to GDP via agriculture export earnings and basic livelihoods of people. Infrastructure like roads, electricity and potable water are expanding around this sector. The health sector and communications are also expanding in response to investments in irrigated agriculture. This key position of water is reflected in the water policy and reforms taking place in Swaziland. There is thus potential to better utilise water through better management across all sectors using a package of relevant instruments (regulation, education, community-based social marketing, economic instruments etc). However, there is currently a lack of coherent data on the practice, and this presents a barrier to implementation. Such cases as occur therefore would be documented as incidences of best practices. This paper explores the current and emerging practices on water management in Swaziland, on the back of the increasing demand. That paper concludes that the irrigation sub-sector shapes water policy ahead of other sectors like tourism and manufacturing. Incidences of both supply and demand management feature. Newly formed water users associations are playing key roles in water allocation. The case for economic instruments (e.g. pricing, taxes, and water trading) for water demand management still needs to be elevated to move water from lower to higher value uses. Supply side dynamics are also demonstrated to be in an accelerated development phase, in response to demand.

Introduction

Swaziland is landlocked country in Southern Africa. It covers an area of 17,364 km^2, and has a population estimated at just below one million people. FAO (2005) estimates indicate that 76 % of the people live in rural areas. The economy is dependent on the agricultural sector, which contributed 11 % to GDP in 2006, compared to 45 percent from industry and 34 percent from the services sector. The contribution of agriculture to GDP has declined from 22 % in 1986 whilst the rural population has remained steady.

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Swaziland is classified as a lower middle-income country with a per capita income of US$2 280 in 2005 (FAO).

As a result of the importance of agriculture in Swaziland's economy, the government is implementing an aggressive water development program. Water utilisation is expected to stimulate the economic development of the country.

The water development program is however framed by scarcity. In many areas, the available water resources are unable to meet the growing needs of users. The water resources in the river basins are variable in time and space. New entrants into commercial agriculture are now demanding water use rights. As the standards of living are improving, the demand for potable water is also increasing, particularly in rural areas where access is now estimated at 60 %. All this is against a background of the water as a national resource as enshrined in the Water Act of 2003. The act specifies that it shall not be necessary for any person to obtain a permit for the use of water for primary purposes. The core arguments are thus centred on the sharing of water across different sectors to achieve growth, as well as across national boundaries.

At a global level, the debate around this subject crystallised the principle of Integrated Water Resources Management (IWRM), which at its core recognises the river basin as the unit of resource management. The IWRM principle has been promoted for adoption as a platform for formulating and implementing water policies across all levels of governance. Swaziland has participated in this debate particularly at regional level. This has translated into implementation of facets of the principles in an attempt to achieve optimal sharing of water across sectors in country, as well as sharing this flowing resource with those other nations.

Because of the government's strategy for water resources development, this is placing water resources under closer control of sectoral players. It is thus important to understand the dynamics of water management in the light of such new challenges. Optimising cross-sector sharing of water resources is an appealing intervention for policy makers as the costs of negotiation are lower when compared with trans boundary issues. This optimisation is challenged however by sectoral interests, particularly irrigated agriculture.

Objectives

The objective of the paper is to review the water management practices and how they are evolving and shape water policy in Swaziland.

Water resources of Swaziland

The total renewable water resources of the country are 4.51 km^3/year, with 1.87 km^3/year or 42 percent originating from South Africa. There are four major rivers in Swaziland (FAO. 1994) that are also shared with South Africa upstream and Mozambique downstream as shown in see Figure 1. The Komati and Lomati systems, in the north of the country originate in South Africa and flow to Mozambique and Indian Ocean via South Africa. The water resources of the Incomati basin are intensively used and this has led to tension among the three countries (van der Zaag, et. al., 2003). Irrigated agriculture consumes the bulk (870 Mm^3/annum) of water, of which 67% is applied to sugar cane. The Mbuluzi River rises in Swaziland and flows into Mozambique. This is another of the river systems that requires cooperation between the two countries in an effort to equitably share resources. Effective implementation of this is affected by hydrological data uncertainty and insufficient institutional capacity (Juizo, et. al., 2006). The Usuthu River originates in South Africa and flows out through Swaziland into Mozambique, forming the border between Mozambique and South Africa. The Ngwavuma, in the south of the country, rises in Swaziland and flows into South Africa before entering Mozambique.

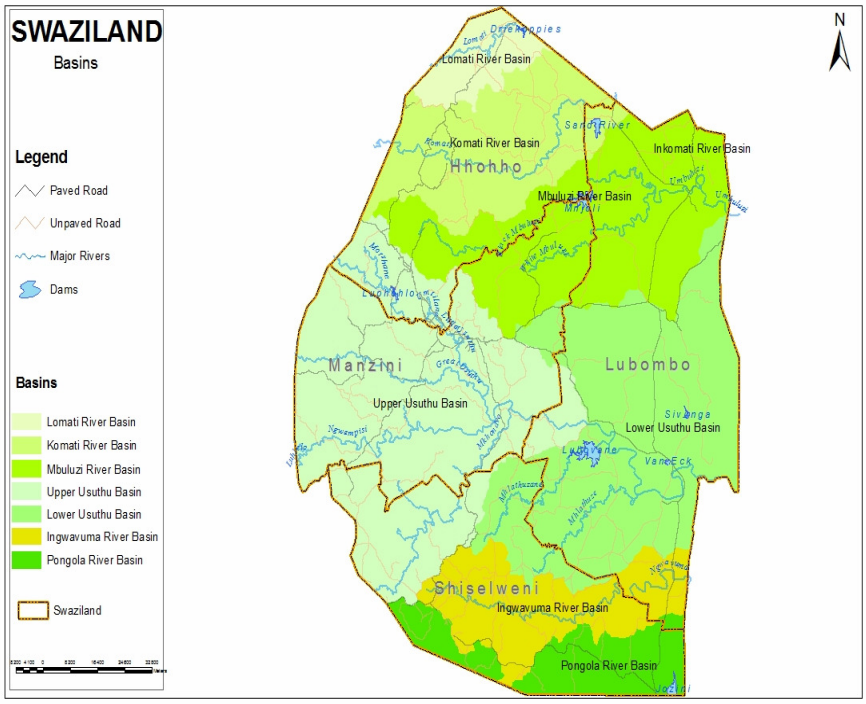

Figure 1: Major Rivers of Swaziland

There are no major aquifers, and so the yields are low. Groundwater sources are used mainly for drinking, especially in the drought prone areas

There are nine major dams with a height of more than 10 metres and with a total storage capacity of about 585 million m^3 (Table 1). Among these, seven dams are used for irrigation purposes, one for hydroelectric purposes and one for water supply. However, a larger dam, Maguga Dam, was constructed and completed in 2002 for purposes of irrigation, hydroelectricity generation, and tourism. One dam is currently under construction and its main purpose shall be irrigation of sugarcane and other crops. Total withdrawals for agricultural, domestic and industrial purposes is estimated at almost 1 km^3. Irrigation uses about 90-95 percent of the water resources in the country (Table 2).

Table 1: Main dams in Swaziland

Dam	**Capacity (x10^6 m^3)**	**Date established**	**River system**
Maguga	332	2001	Komati
Mnjoli	153	1980	Mbuluzi
Sand River	50.3	1965	Komati
Luphohlo	24	1984	Usuthu
Henrick van Eck	9.87	1969	Usuthu
Sivunga	5.92	1972	Usuthu
Nyetane	6.78	Raised 1992	Usuthu
Hawane	2.75	1984	Mbuluzi
Lavumisa	0.35	1996	Pongola
Total	**585**		

Table 2: Water use by sector in Swaziland (2000)

Category	**Water withdrawal (x10^6 m^3)**	**Water withdrawal (%)**
Irrigation	992.65	95.3
Livestock	12.51	1.2
Domestic-Rural	9.75	0.9
Domestic-Urban	14.43	1.4
Industry	12.02	1.2
In stream use	-	-
Total	**1041.36**	**100.0**

The use of water in Swaziland is shaped by the geography of the country as well as the key occupation for the people. The country is divided into four physiographic regions

that run almost parallel in a north-south direction. Table 3 shows the distribution of this land.

Table 3: Agro-ecological regions of Swaziland

Region	**Description**	**% Area**	**% Population**	**Arable Land (%)**
Highveld	Upland area, mountainous, with high rainfall and mild temperatures	-	31	13
Middleveld	region is warmer and drier than the Highveld	28	41	20
Lowveld	Relatively flat and low-lying, with a marked drought hazard but with good soils.	-	24	12
Lubombo Plateau	The Lubombo plateau rises abruptly from the Lowveld, wooded bushland	-	4	12

Source*:* Central Statistics Office

The climatic and topographic characteristics of these zones play a significant role in determining the land use patterns of the country which in turn affect water use. The main land uses include small-scale subsistence agriculture, large-scale commercial agriculture and communal grazing. However, productivity on the predominantly peasant sub-sector is low. Efforts towards improvement of productivity in agriculture so as to increase agricultural productivity are constrained by lack of water. The state of affairs for water resources in Swaziland is as intricate as elsewhere in the world. The spatial distribution of water is uneven across the country; water sources are often not located where the demand is, so requiring reservoirs and conveyance systems to bring the water to the user, hence the need for storage. This also points to need for effective water institutions management of the water.

Water Management Institutions

The key water management institutions in Swaziland are enshrined in the Water Act 2003. They comprise a National Water Authority with roles for planning policy formulation and monitoring water use. The Joint Water Commission for deals with transboundary water issues. The Water Apportionment Board is temporary body that will carry out functions of river basin authorities until such time as the river basin

authorities are established. Water Users Associations are the bodies made up of the water users.

Irrigated agriculture – production and water demand

Agriculture is a key sector in Swaziland's economy, and is the main source of income for more than 70% of the population in rural areas. It remains the single largest foreign exchange earner despite a fall in its share of Gross Domestic Product from about one-third in 1968 to 11 percent in 2006. The agriculture sector is expected to have expanded by 2.1% in 2003 after growing by 1.8% in 2002 (SADC Review, 2006). It provides the inputs for agro-processing industries that form the backbone of the manufacturing sector. In fact, farming remains by far the engine of the country's socio-economic development.

The cultivated area is estimated at 190,000 ha, of which 178,000 ha are under annual crops and 12,000 ha are under permanent crops. Maize is the most important crop in Swazi Nation Land (SNL); however there has is an increase in the number of farmers on SNL growing sugar cane, especially those with irrigation facilities.

The irrigation potential for the country, based on the physical land capability and water availability, is estimated at 93,220 ha. In 2000, 49,843 ha of land were under irrigation, with over 40,000 ha being used for irrigated sugar cane. However, in the year 2003 irrigation use on sugarcane increased and the total irrigated land under cane is estimated at more than 50,000 ha.

Over 84 % of the irrigated land is in the Lowveld, with 15 % in the Middleveld. About 52 % of the land is under surface irrigation, and 48 percent is on other systems (drag lines, fixed sprinklers, centre pivots. This distribution of irrigation methods is changing over time in favour of more efficient overhead and trickle methods, as farmers feel the pinch of water availability. In the year 2004/2005, farmers in the Komati River Basin where supplied 75 % of demand as a result of the low level of water in Maguga Dam, the source. This exemplifies demand management by rationing, a situation highlighting the need not only for more efficient irrigation methods for farmers, but also a well grounded demand management approach using pertinent instruments.

Over 4000 ha are small scale farmer managed schemes, irrigated by mainly overhead methods with pumping. The trend to use overhead methods was spurred by increased demand for water across all sectors. By default, use of overhead methods results in farmers incurring energy costs. This in turn is forcing farmers to be water efficient. This trend is mirrored in the large scale as well.

Sugar cane is by far the dominant irrigated crop in the country, covering over 91 percent (more than 50 000ha) of the harvested irrigated cropped area. Sugar is still the largest single foreign exchange earner (SADC Review, 2006), (see Table 4). Next comes citrus, covering almost 6 percent. Smaller areas are covered by vegetables, maize, potatoes, rice and bananas. The sugar industry, which is the main irrigation industry in the country, provides direct employment to about 16,000 people, and about 20,000 people benefit from the industry indirectly.

Table 4: Sugar production in Swaziland ('000 tonnes)

	2000/01	**2001/02**	**2002/03**	**2003/04**	**2004/05**
Sugar (tonnes)	528 241	500 680	583 014	628 191	594 127
Export volume (tonnes)	275 727	208 095	296 800	265 291	243 198
Export value (E million)	644.8	647.2	689.0	762.2	758.4

In addition to the water for crops, people settled in the sugar producing areas or basins also demand water for domestic use. This is leading to interesting scenarios where communities rely on the same source of water for their livelihoods as well as for home life. Such scenarios are likely to lead to tensions that must be resolved through compromise on improved water management approaches, (allocations and demand management, water trading). To a degree, such tensions are now being recognised, and solutions are being incorporated in water policies discussed in the following sections.

Changes in EU-ACP preferential markets for sugar

As the country looks forward, exogenous challenges loom on the horizon that have an impact on irrigated agriculture. One such challenge is the announced reduction in the price of sugar in the European preferential market by 39 % by 2009. Under the Sugar Protocol to the Cotonou Agreement, Swaziland benefits from a quota of 120 000 tonnes and they also export 30 000 tonnes under the Special Preferential Sugar (SPS) Agreement with the Group of Four (which also includes Cote d'Ivoire, Malawi and Zimbabwe). The Swazi sugar industry estimates total annual losses to the country of about EUR 30 million. The price cuts would come as a double blow to Swaziland as the country's sugar industry has already had to sustain a 37% decline in the value of the Euro against the since 2002, which was the main factor contributing to a 21% decline in the sucrose price between 2002 and 2004 (Kinnock and Chulumunda, 2006).

Reduced viability of sugarcane farming may cause transfer of water from sugarcane to other crops. There has been a lag so far in such diversification. This is due to the natural delay as some projects were already committed to the investment.

The irrigated sugarcane area begs explanation. A number of factors, past and present, contributed to the shift to irrigated sugarcane. First, the government of Swaziland is at the forefront in developing the supply of water resources. It is formulating and implementing an enabling policy environment which has resulted in development institutions which are geared for and have a primary interest to sustain the sugar industry in Swaziland. A number of lending institutions have positioned themselves to lend to the sugar industry, riding on the back of the strong organisational structure of the sugar industry in the country, and also on improved water availability due to the new storage facilities. The GOS framework has spearheaded the development of physical infrastructure like Maguga Dam (2002), Lower Usuthu, (2008) and Mkhondvo, planned for the future.

The process is also guiding the devolution of water management to the local level, witness the formation of water users associations (WUA) in key river basins. The stakeholders in the sugar industry have over time evolved well structured products that have enabled irrigated agriculture. For instance, communally owned land targeted for irrigated sugarcane is accepted as collateral for borrowing because a land use guarantee is issued by the chief ("chief's letter"). This has unlocked the value in the land and so made irrigation development possible on borrowed funds. As a risk management position, lenders are able to collect loans repayments via the sugar mills; the primary receipt point for sugar sells proceeds. The major beneficiaries of this state of affairs are the small scale farmers who currently have the undeveloped land and so growth is being witnessed in this sub-sector.

Evolution of water policy

Swaziland did not have a clear policy on water use and management until recently (Zaikowski, 2007) when the Water Act of 1967 was replaced by the new Water Act of 2003. The overall management of water resources was on an ad hoc basis through several uncoordinated pieces of legislation, spread among a number of Ministries as well as other institutions outside the government, that were aimed at solving specific issues without due consideration to harmonization. The legislature previously used in Water Management included the:

- Water Act of 1967,
- Protection of Freshwater Fish Act of 1938,
- Swaziland Electricity Act of 1963,
- Water Services Act of 1992,
- Komati River Basin Water Resources Development and Utilization Act of 1992,
- Joint Water Commission Act of 1992,

- Swaziland Environmental Authority Act of 1992,
- Swaziland Administrative Order of 1998 and the Borehole Act of the Geological Surveys and Mines, and
- Drinking Water Quality Guidelines of 1998.

The Water Act of 1967 faced a litany of challenges. These included issues of water pricing whereby the value of water was not considered leading to wastage. Water allocation was attached to a portion of land and the permits were in perpetual ownership. Further, water management was mainly by the State. There was poor representation of users in water management institution and representatives were appointed by the responsible Minister. Pollution control and monitoring was not given the importance it deserves to an extent that pollution penalties were negligible charges. Such challenges as the above derived from the irrigation interests on which the water act was founded.

The new Swaziland Water Act of 2003 was developed along the principles of Integrated Water Resources Management (IWRM), meaning that water resources will be conserved, developed, used, and managed in a sustainable, efficient and equitable manner. Sustainability, equity, efficiency of water resources are the main principles advocated by the new Water Act of 2003. The Water Act proposes the establishment of the National Water Authority, River Basin Authorities, Irrigation Districts and Water Users Associations. These institutions have a task of the overall management of water resources at national and basin level.

In the new Water Act, water is considered a common asset and a decentralized system of management is proposed. The IWRM principles advocated by the new Water Act of 2003 apply more broadly integrating management of water for crops, livestock, and fish; promoting water harvesting, applying integrated basin management, and promoting stakeholder participation.

Irrigation and water policy

Irrigation has received a dominant attention from the colonial period to the present time. Swaziland is largely dependent on agriculture for economic gain and therefore a great emphasis on the Water Act deals with irrigation and the Act has a clear bias in that direction.

The importance of sugar cane irrigation is evident in the 2003 Water Act were by in the National Water Authority (NWA), the Swaziland Sugar Association nominates a member to be appointed by the minister to seat on the NWA board, one each from Swaziland Citrus Board and Commerce and Industry (Water Act, 2003, Section 4, sub-section 3).

In addition, there shall be three appointees from associations, cooperatives and individuals from SNL. Considering the above, it is clear that a majority of representatives will be from the agriculture sector and mainly irrigated agriculture. Furthermore the Water Resources Master Plan is mandated to secure sufficient water resources for, among others, agricultural needs (Water Act, 2003). It is of interest that the selection criteria for selection of users into the NWA will be based on familiarity with one of major rivers and the knowledge on major crops grown. In the same water act, the Swaziland Sugar Association will have membership in the Water Apportionment Board. All these indicate to the importance of irrigation in the Swaziland and how irrigation, especially of sugar cane, is accommodated in the Water Act.

Swaziland relies heavily on agriculture and as a result the focus on irrigated agriculture is mainly for economic reasons. Irrigation development and management receives great attention and more investments compared to other sectors. The principle is that, improving irrigated agriculture performance through institutional and policy reform would make a large contribution to the economy. Large investments are made in constructing and operating major dams so as to meet the objective of poverty alleviation. Water management is seen as the panacea for the poverty situation in the country and it is in this spirit that irrigated agriculture receives attention. Irrigation has thus always been the primary goal, with other water sub-sectors like energy generation, recreation, industry domestic water, etc forming secondary users in a multiple use system. Suffice to say that specific sites have been exploited for use to which they are best suited, as for instance the hydro electric scheme at Luphohlo. In pursuit of irrigation, the country has therefore managed to match needs of other sub-sectors, around irrigation needs. This trend is forecast to continue as with the available water resources Swaziland could be able to irrigate more land.

In practice, water governance, management, and use in Swaziland remain highly sector focused and demarcated. This is visible in the design of water organizations and in the disciplinary focus of water resources education. An important dimension of the Act is the attempt to organize farmers into Water User Associations (WUAs), Irrigation Districts (IDs) and River Basin Authority (RBAs). The primary focus on the membership into these institutions has been land ownership, thus indicating the bias towards agriculture and irrigated agriculture. There are no other clearly organised water users group such as the irrigation water users in the country. These groups receive technical support, capacity building and training programs from both government and private sector institutions. Training these farmers benefits not only the farmers but also government in her pursuit for efficient and effective water resources management since most of the country's rivers are shared. A more recent trend has been to promote river basin organizations to manage competition for water at the basin level

The dominance of irrigation pervades many aspects of water resources management such that in Swaziland the Water Act does not deal much with water supply for domestic use and the water supply policy is not readily available or known to many citizens. The situation of the tariff structure on the domestic water supply side can hamper progress made on implementation of the IWRM principles, as the poor people would not be catered for, thus potentially compromising the objective of provision of clean water to rural communities or even widening the gap between community members.

Further bias on irrigated agriculture can be observed in the disciplinary focus of water resources education and educational programs offered by higher learning institutions and other professional institutions in the country. Educational programs offered within the country all tend to focus on irrigation use and management and little or no programs focusing on other water uses. It is not therefore surprising that Swaziland does not have adequate research studies conducted on other water uses but a majority of water research studies conducted is on irrigated agriculture. Educational programs focusing on other water uses are sourced from outside the country.

Water Demand Management

In Swaziland, there is potential to better manage water use through demand side management across all sectors using a package of relevant instruments (regulation, education, community-based social marketing, economic instruments etc). Evidence from other resource sectors like energy suggests that resource management is somewhat sensitive to properly implemented demand management. However, there is currently a lack of coherent data on the practice in the water sector in Swaziland, and this presents a barrier to implementation. Such cases as occur therefore would be documented as incidences of best practices.

Cases of demand management abound and include such practices as subsidies for water infrastructure at all levels of government to increase storage, storage at point of use, widespread water measurement devolved to user level in irrigation, water conservation and rain water harvesting. For instance, Swaziland development agencies subsidise potable water through a capital grant in rural areas at about Euro 1000-2000. A charge is levied for the water on a monthly basis, ranging from Euro 0.25 to 1.25. Some of these cases of demand management have a long history, and others are more recent. The drivers for these are also variable, as for instance water conservation is driven more by scarcity of water in some areas rather than as a demand management initiative. Rationing is also a forced tool. However, in the Komati River basin, newly formed water users associations are conducting metering, ordering of water and in the process having heightened awareness of demand management practices. Currently,

small scale farmers pay for water through the energy path when they pump. Such initiatives have been enabled by policy, legislation and supporting institutions. On other hand, the large sugar growers in Swaziland have had a long history of well organised water management sections that have contributed to improved efficiency.

The case for economic instruments like pricing, taxes, and water trading for water demand management still needs to be elevated. Economic instruments can be used to provide financial resources and to also move water from lower to higher value uses. At the sugar estates, the transition to more efficient irrigation technologies maybe an early proactive initiative to such forces. The two major sugar estates in the country are changing their irrigation systems from surface and dragline sprinklers. One estate now has some 10255 hectares of drip irrigation out of the 21,000 hectares they manage. The other is converting to centre pivots and have some 8000 hectares. It is important to note the change over is motivated by both the need for water and energy savings. The spillover of this transition by the large is that smaller producers are emulating the practice, potentially leading to water savings.

The transition ought to be interpreted with caution, however. In planning and irrigation scheduling, local practitioners use ET_c =7.5 mm/day to 7 mm/day. CROPWAT modeling shows that ETc of between 5.0mm/day and 6.0 mm/day could be used for water savings of 17 %. Use of the above conservative figures suggests conscious efforts to manage risk. An economic instrument like correct water pricing could in principle be brought to bear to achieve equity.

It would appear then that demand management practices are still in their infancy in Swaziland. This is not for lack of practice, but rather for want of complimentary policy packages supported by research. Documentation and improvement on lessons learnt from practice will thus be an important learning path. Transfer from research to practical application will require further evaluation for effectiveness before conclusions can be made on meeting of objectives and applied strategies.

Conclusion

First, water governance and management in Swaziland remains highly sector focused and biased towards agriculture in spite of its importance to the whole economy. Although other infrastructure sectors like roads, electricity network grid network expansion and potable water are developing around this sector, the interests of irrigated agriculture predominate. This key position is reflected in the water policy and reform taking place and going all out to accommodate irrigation by default. Therefore the sub-sector will continue to shape water policy, legislation management and allocation until

such a time as other sectors like tourism and manufacturing have the weight to push expansion of productive capacity of the country.

Second, the institutions for water management are still in infancy in Swaziland. This suggests that water management practices are still evolving along with the institutions.

Third, irrigation is also likely to continue having an important role as long as the transition of Swaziland's economic institutions for higher levels of output remains one of the primary goals of the country. Pushing out the production function is a policy objective supported by many multi-lateral funding agencies assisting Swaziland's development. This convergence in goals will serve to perpetuate irrigation's continued dominance as a development vehicle. Irrigation technology is weighting towards efficient approaches like trickle and overhead methods in Swaziland as a pull because of the inherent water stress situation of the country. The science of crop water use estimation is being applied to improve efficiency in the sector. This de facto restructuring, changing the underlying technological base of the sub-sector for efficient technology may realise water savings that are could be applied to other sectors without recourse to the remaining common pool.

Finally, we note that this review was carried out from an agricultural and irrigation perspective. In order for water resources management to be optimised, it has to be discussed in the wider perspective of water and economic policy.

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