How to finance multiple use water systems for the rural poor? Lessons learnt from the domestic water sector in the Olifants River Basin, South Africa

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Abstract:

Designing financing mechanisms that ensure an improved access to water for rural poor and in the same time the sustainability of water services has been identified as a cornerstone for fulfilling the goals of the water policy in South Africa. This paper focuses on characteristics of rural water supply in terms of level of services, costs and financing, a subject less studied than determinants of water demand. It presents the new water policy in South Africa and the resulting institutional setting for the domestic water sector. Based on a study area (the former homelands of the Olifants river basin) where data have been collected, it then points out the following results: firstly, it seems difficult to identify the main determinants of costs due to the extreme variability of situations, even in specific area like the former homelands. However, water costs per capita increase with the quantity of water delivered without economy of scale due to an improvement in water technology and in service quality. The research also shows that very few water-pricing policies are implemented, everyone, including poor people having a free access to water. The conclusion raises concerns about future sustainability of existing systems and presents some research questions that are being addressed by the MUS project.

Key-words: domestic water supply; rural areas; South Africa; costs; tariffs; subsidies

Résumé :

La conception de mécanismes de financement permettant à la fois d'améliorer l'accès à l'eau des populations rurales pauvres et d'assurer la durabilité des services d'eau est considérée comme une condition fondamentale pour l'accomplissement des objectifs de la politique de l'eau en Afrique du Sud. Ce papier se concentre sur les caractéristiques de l'offre en eau en zone rurale en termes de niveau de service, coûts et modes de financement, une question moins souvent abordée que les déterminants de la demande en eau. Il présente la nouvelle politique de l'eau en Afrique du Sud et les arrangements institutionnels qui en résultent pour le secteur domestique. Sur la base des données collectées dans la zone d'étude (les anciens homelands du basin de l'Olifants river), les résultats suivants sont présentés: Il semble difficile d'identifier les principaux déterminants des coûts de l'eau, en raison de l'extrême variabilité des situations, même dans une région aussi spécifique que les anciens homelands. Cependant, les coûts de l'eau par tête augmentent avec la quantité d'eau délivrée sans économie d'échelle à cause d'une amélioration parallèle des technologies utilisées et de la qualité du service. La tarification de l'eau est très rarement appliquée dans la zone d'étude, l'accès à l'eau étant gratuit pour tous en particulier pour les plus pauvres. La conclusion soulève la question de la durabilité des systèmes existants et présente quelques unes des questions de recherche traitées par le projet MUS.

Mots-clés: eau domestique; zones rurales; Afrique du Sud; coûts ; tarification ; subventions

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1. Introduction

In rural and peri-urban areas of developing countries, everyone uses water for various 'domestic' purposes and many people use or could use water for 'productive' purposes to earn an income, such as gardening, field crops, livestock, brick making. Yet in most cases, water sources, uses and users are not well integrated, leaving much scope for improvements in water use efficiency, livelihood, and equitable water use. Examples of such improvements are: more accessible and cleaner water for households, expanded water services that allow productive uses, more reliable water supply through new institutions that enable effective interactions between end users and providers of water. Such improvements increase the ability of water users to pay for installation and maintenance of the systems, which in turn prepares the ground for accelerated up scaling and implementation of multiple-use systems. (Moriarty *et al.* 2004).

The domestic water sector in South Africa is characterised by important inequities in terms of access to water inherited from the apartheid era, despite the tremendous investments in water infrastructures made by the governments since 1994 and the significant institutional changes promoted by the 1998 National Water Act and the 1997 National Water Services Act (Republic of South Africa 1998b, 1997). The provision of Free Basic Water and a more equal distribution of water for productive uses (irrigation, mining, industry) are seen as important instruments to redress inequities from the past and eradicate poverty (Republic of South Africa 1996). Among the main challenges facing the water sector is the provision of free access to basic water services for all the users and at the same time promoting and planning for providing higher levels of service, that can accommodate for productive uses of water and broader livelihoods options (DWAF 2003c).

Designing financing mechanisms that ensure an improved access to water for rural poor and in the same time the sustainability of water services has been identified as a cornerstone for fulfilling the goals of the water policy in South Africa. However, if several studies analyze the determinant of water demand and the willingness to pay of users (Goldblatt 1999; Banda *et al.* 2004; Hope and Garrod 2004), characteristics of rural water supply in terms of level of services, costs and financing have been less studied. The objectives of this research are (i) to assess the costs of the various water supply systems in South African rural areas; and (ii) to inventory the different financing mechanisms (directly via water tariffs and indirectly through subsidies) of these systems; and (iii) to analyse the potential of the various identified financing mechanisms to address the requirements of full multiple-use water services. As a first step, the study is restricted to the domestic water supply, and will then be extended to irrigation water supply.

This paper is based on the research undertaken by Marie Lefebvre in fulfilment of her Master degree (Lefebvre 2005). This research is part of a broader project on Multiple-Use Systems (MUS), led by the International Water Management Institute (IWMI), which seeks to design, test and promote models, guidelines and tools for the upgrading of existing systems to systems where sources, uses and users are effectively integrated (Penning de Vries *et al.* 2004).

The paper is organized in 7 sections: section 2 presents the new water policy in South Africa and the resulting institutional setting for the domestic water sector; section 3 gives a rapid overview of the study area, the former homelands of the Olifants river basin; section 4 sets the framework for analysing existing tariffs and subsidy systems; section 5 describes the method used for data collection; results are presented and discussed in section 6; conclusion and perspective for further research are drawn in section 7.

2. The new water policy in South Africa: institutional framework and challenges

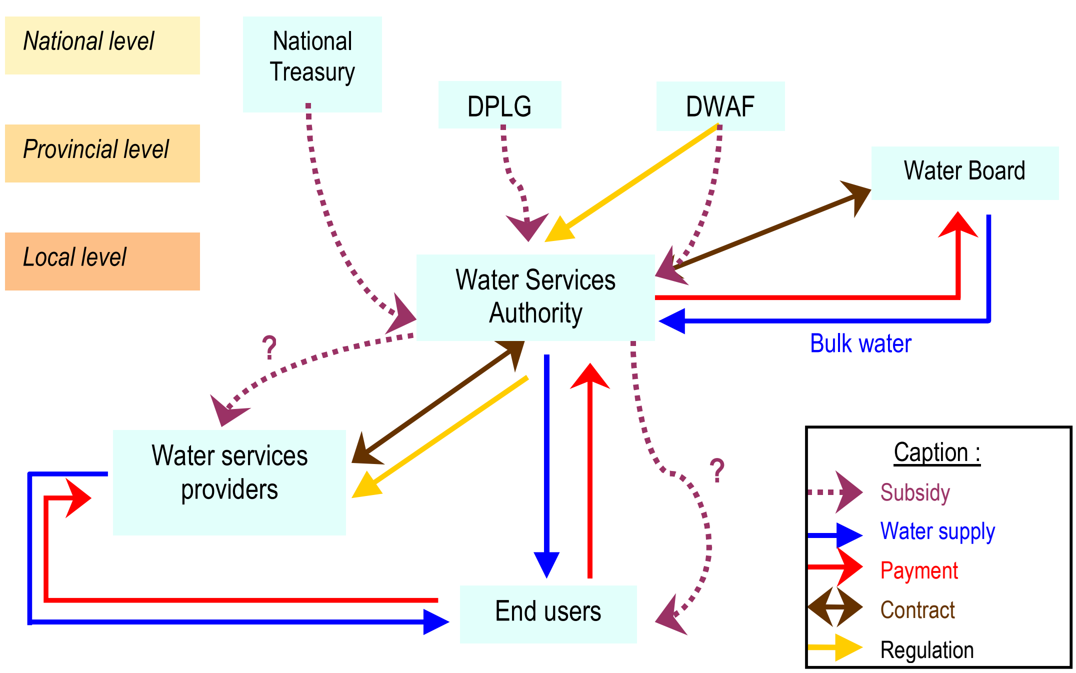
The National Water Act (NWA) (Republic of South Africa 1998b) represents the key reference for water policy in the South African post-apartheid democratic context. It promotes integrated and decentralised water resource management in a new institutional environment.

Social development, economic growth, ecological integrity and equal access to water are key objectives of the new water resource management legislation (Hassan and Farolfi 2005). The NWA defines water resource as a public good belonging to all people. Recognising the current inequitable resource allocation (due to geographic characteristics but also to the discriminatory practices of the apartheid period), it insists on the need of an integrated management and strong institutional framework for water services provision in order to redress inequities from the past.

According to the Water Services Act (Republic of South Africa 1997), water & sanitation provision for domestic purpose is recognised as a duty for local governments with the financial and technical support of provincial and national governments. Furthermore, the provision of free basic water and sanitation services for all end-users is compulsory. The Act introduces the notion of basic services, which in terms of water supply means for a household composed by 8 persons an amount of water corresponding to 6 m^3/month, available at less than 200m from the dwelling. According to World Health Organization (WHO) standards, this is the minimum amount of accessible water to promote a healthy living.

The current water services sector landscape is particularly complex in South Africa (Figure 1), mainly because of dynamic and sometimes-chaotic legislative implementations since the end of the apartheid. All levels of government are well represented in this sector: national, provincial and local (Thompson *et al.* 2001). In view of the decentralisation principle, provincial and local governments are now new spheres of government in their own right and duties and not anymore emanations of the national government.

Figure 1: Institutional organisation of domestic water services in South Africa



At the national level (and at the provincial one through decentralised offices), the Department of Water Affairs and Forestry (DWAF), the Department of Provincial and Local Government (DPLG) and the National Treasury (NT) are the key actors. DWAF is the national department responsible for both water resources management and water services provision. During the period immediately following apartheid, the Department took in hand some water networks previously managed by homelands governments. These networks are being transferred to

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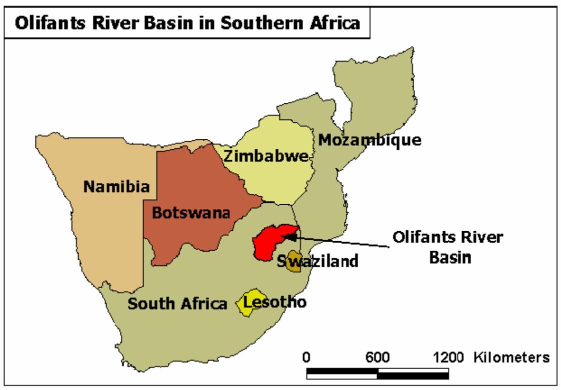
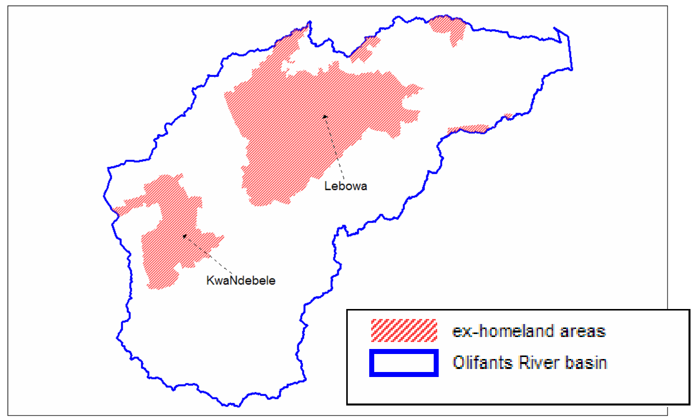
3. The former homelands of the Olifants river basin: a very unequal access to water services

The research took place in the Olifants river basin, a benchmark basin for the International Water Management Institute, located in the North-East of South Africa and covering part of the Mpumalanga, Gauteng and Limpopo provinces. It focused specifically on the former homelands[6] of Lebowa and Kwa-Ndebele, which constitute the poorest rural areas in the basin (Figure 2). They together represent 25% of the total surface of the basin but 57% of the population. Due to the isolation imposed by the apartheid government, these areas show socio-economic figures significantly different from the other part of the basin and suffer huge backlogs in basic services supply.

Figure 2- Location of the research area: the Olifants river basin and its former homelands





Source: Lefebvre (2005) and IWMI database

The Olifants river basin is characterised by a semi-arid climate, with two marked seasons. Increasing water demand for irrigation, mining, industry, power generation and urban and rural domestic use already represent a large proportion of the available water resources. Seasonal shortages already occur in some parts of the basin. The water resources are also affected by pollution from agricultural, mining and industrial activities located upstream of the basin. This creates a serious concern considering that some populations consume non-treated surface water, especially in poor rural areas.

The population distribution patterns show the legacy of the apartheid era: former homelands are densely populated (100 to 300 inhabitants/km²) mainly by black people (only 0.2% of whites against 5.8% in the whole basin), whereas in former "white-only areas"[7] the density rarely exceeds 100 inhabitants/km². In former homelands, the population is also heavily touched by HIV (one person out of three is believed to be affected), which already affects its growth rate.

The main economic activities in the Olifants river basin are mining, industries, power generation and agriculture. In former homelands, rainfed agriculture, together with pensions and grants from government, is often the main source of income of households. According to

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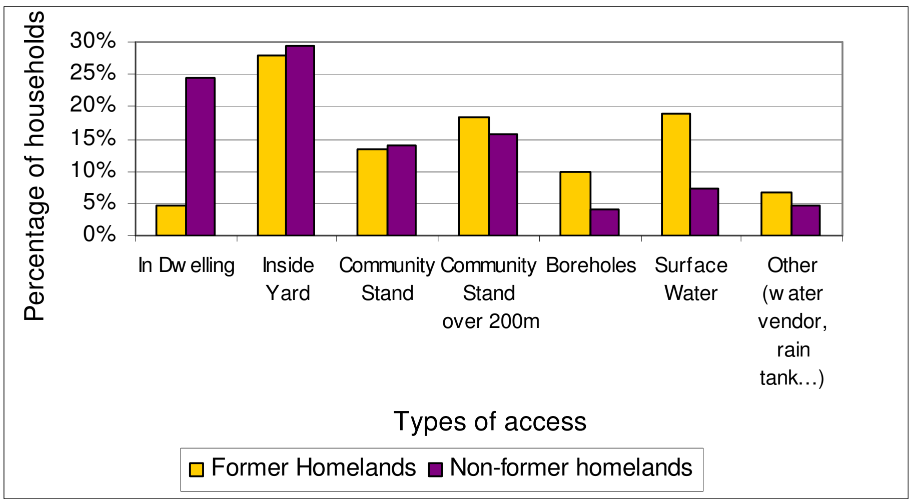
[6] From the Natives Land Act of 1913 on, a number of homeland areas were delineated according to ethnic, geographical and economic criteria, and formed "reserves" for black people. Such spatial discrimination was developed and implemented further under the apartheid regime. Reserves were granted some form of autonomy from central government. Some of them ultimately were declared self-governing independent states (Bantustans), although not recognized internationally. Homelands and the so-called independent Bantustans have all been re-incorporated into the country in 1994.

7 The term "white only area" refers to areas where only white people were free to live and possess a home during apartheid.

the 2001 Census, more than 74% of the basin population declared having no income. In the areas of Lebowa and Kwa-Ndebele only, this figure grows up to 80%.

The study area suffers from huge backlog in terms of water supply and sanitation. In 2001, according to census, only 49% of households had access to piped water at less than 200m from dwelling, which is the standard adopted by the South African policy (against 72% for the whole country and 57% for the Olifants basin). Figure 3 compares the access to water in former and non-former homelands areas in the Olifants river basin [8]. Inequality of access to adequate sanitation is even worse: 22% of households have access to improved sanitation (pit latrine with ventilation or flush toilet) in the study area against 33% in the Olifants basin and 59% in the whole country.

Figure 3 - Distribution of population according to type of water access in former homelands and non-former homelands areas of the Olifants river basin



Source: Lefebvre (2005) from Statistics South Africa Census 2001

4. A framework for the analysis of water pricing and costs of rural water services

Before presenting the framework to analyse water pricing and costs of rural water services, it is important to define what we include under the terms employed.

Under water pricing policies, we mean the total amount of money paid by a consumer to have access to domestic water and to sanitation services if any, and the tariff structure. Water is priced according to a generic function: $B = aX + b$ (with B: total bill, a: the proportional part based on water consumption, X: water consumption level, and b: the fixed part). Three main types of water pricing can then be found: (i) if $a = 0$, the water bill does not change with water consumption level: it is a flat rate structure; (ii) if $b = 0$, the water bill is strictly proportional to water consumption: it is a volumetric rate structure; and (iii) if (a) and (b) are strictly positive, it is a two-part rate structure.

The proportional part (a) can either be constant whatever the level of water consumption or priced "per block". The block pricing can then increase with the consumption level (increasing block rate) or decrease (declining block rate). Complex pricing structures combining increasing and declining steps can also be found. Including in increasing block rate, one

[8] "in dwelling" represents an access to water inside the house. "Inside yard" is an access (a tap) on the property but outside the house. Community stand represents a collective tap in the street, for the use of all households in the neighbourhood. "Borehole" indicates access to water via a borehole. And "Surface water" is access to a river, spring or dam. "Other" represents various accesses like rain tanks and water vendors.

finds the so-called “volumetric pricing with flat part”: it combines a zero-charge for the first cubic meters included in the flat part, possibly with a fixed part, and a proportional rate on extra cubic meters.

The fixed part (b) can be priced on the basis of different but non exclusive criteria: (1) the liable person: the subscriber, the number of served flats, the number of inhabitants and/or the duration of stay; (2) the connection: the size of water pipe determines the level of the fixed part; (3) the level of consumption (e.g. a fixed rate for a fixed volume of water). Others indexes are also found, such as the size of the house, the number of taps, etc.

Through water price, water utility managers try to achieve different objectives, although the relative weight of each one may vary depending on the social, economic and environmental context and may sometimes be contradictory (Dalhuisen and Nijkamp 2002; OCDE 1987; Arbués *et al.* 2003). Following Boland and Whittington 2000, the main objectives of water pricing are:

– *Cost recovery*[9]: it is the main purpose put on water price by water utility managers, because it will determine if water services are sustainable.

– *Economic efficiency*, to maximise welfare through equalisation between prices and marginal costs.

– *Equity:* Whittington *et al.* (2002) define it as a situation where similar customers are treated equally (*“users pays monthly bills that are proportionate to the costs they impose on the utility by their water use”).* This sense can be related to economic efficiency. On the other hand, advocates of water as a human right understand social equity as an equal access to water and to the benefits of using water. This is this sense that is used in the South African water policy (DWAF, Guide to the National Water Act).

– *Economic affordability*: water prices can be set to allow everybody to have an access to water. According to an international reference (World Health Organization 2000), to reach this target, the effort rate (i.e. the part of household budget spent on water) must be below 5%.

– *Resource conservation*, to promote a sustainable use of water. As this objective mostly concerns future, it is often forgotten in implementation of water pricing even if it is also often put forwards in legislations.

We can note that additional objectives can be considered, but they must be taken more as constraints: water price must be acceptable by water users; it must be transparent and simple to induce the desired users’ behaviours; finally it must be easy to implement (in particular it must cost less than it allows to earn).

Economic affordability and more generally the guarantee of access to water for everyone, can be reached through a system of subsidies, which is incorporated in the design of water tariff structures. These subsidies can come from outside the water sector (from the government or an external institution, non-governmental organisations, international financing institutions) or from inside (poor water users are then subsidised by richer water consumers). In addition, subsidies can be paid directly to water users or indirectly to water utility managers (Whittington *et al.* 2002).

A good subsidy system must try to reach the four following objectives (Whittington *et al.* 2002):

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[9] Cardone and Fonseca provide a simple definition of ”cost recovery” as “*recovering all of the costs associated with a water system, programme or service to ensure long-term sustainability” (Cardone and Fonseca 2003)*. In the report “*Twelve Successful Cost Recovery Case Studies for Water Services in South Africa”*, DWAF seems to consider cost recovery as the rate effectively paid by users on the total amount of payment expected (DWAF 1998).

– *Genuine need*: subsidy must be given only to poor users, which is not easy. Effort rate surveys and willingness to pay studies can be used to verify that it reaches the right users.

– *Accurate targeting:* beneficiaries must be precisely identified. This can be done through some types of subsidy schemes, like a subsidy given according to the level of water use, to specific areas which are recognised to be the poorest, to household characteristics (income level, presence of flush toilets, number of rooms…) or to the level of water quality service (the diameter of the connection, public or private tap, …).

These two first objectives can be summarised with two standard indicators (Foster *et al.* 2003): the error of inclusion, which arises when "rich" people benefit from the subsidy (which represents a leakage of funds) and the error of exclusion, which arises when poor people do not receive the subsidy.

– *Low administrative costs:* it is usually expensive to identify correctly beneficiaries.

– *No perverse incentives:* households who benefit from a subsidy should not be incited to waste water.

To synthesise, there are two main difficulties in a subsidy scheme: the risk of not reaching the targeted people and the risk of inciting subsidised households to consider water as non scarce. Then, aiming at reaching various and often contradictory objectives a water pricing policy is difficult to design, especially if water utilities want to recover costs, to allocate water in an efficient way and to guarantee an access to every one.

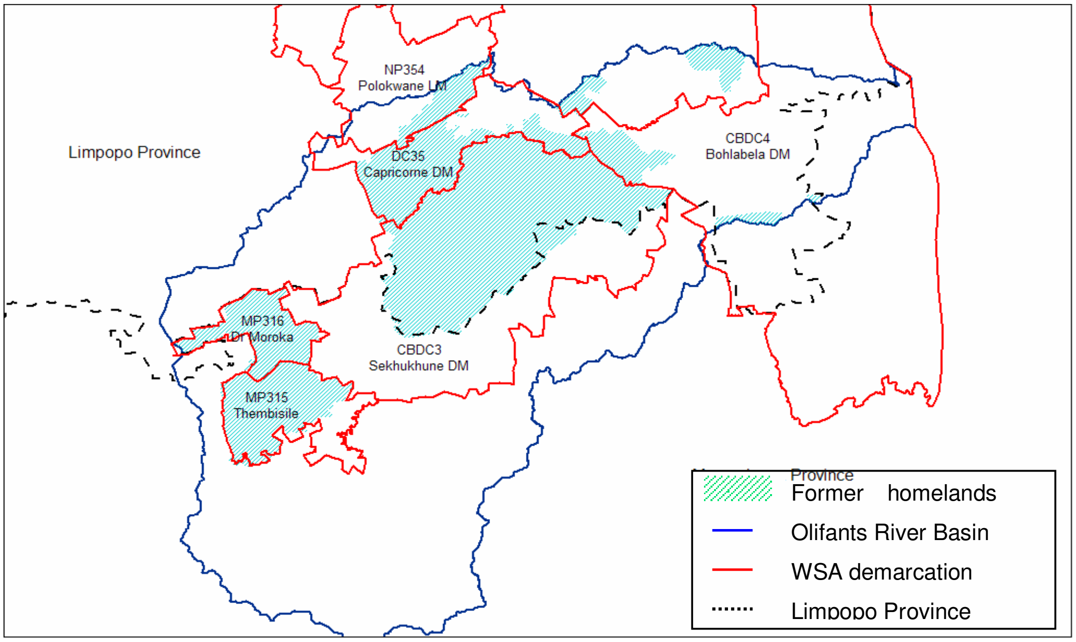
5. A three steps approach

The research approach was threefold:

- The first step consisted in interviewing key-informants in the domestic water sector at national and provincial levels (DWAF, NGOs involved in water supply, consultants, and researchers) and studying the academic and grey literature related to domestic water supply in South Africa. The objectives of this first step were i) to get a better knowledge and understanding of the institutional setting of domestic water services, and ii) to identify the appropriate level for data collection on costs and water tariffs of water supply schemes in the study area.
- During the second step, we interviewed representatives of Water Services Authorities (Figure 4), and Water Services Providers, which operate in the study area, using a structured questionnaire. Questions included institutional arrangements at WSA level, sources of financing (subsidies, water tariffs, application of the Free Basic Water policy), network characteristics[10], recent investments, difficulties experienced in water services management, and view on multiple uses of water. Water Services Development Plans and Integrated Development Plans were also used when available. Due to the limited number of WSAs in the area, data collected were analysed in a qualitative way, with regards to the objectives of water pricing and subsidy policy described above.
- The third step dealt with the analysis of data on water supply schemes provided by DWAF. Before handing over the management of domestic supply schemes to Water Services Authorities, DWAF has done an assessment of the existing infrastructure, the Functional Assessment (DWAF 2003b, a). Available data on the 66 networks present in the study area encompass technical characteristics of the networks as well as financial information about costs and water revenues. A statistical analysis is presented in the next section.

[10] Since DWAF made the Functional Assessment available to us, this part of the questionnaire was not used.

Figure 4 - Water Services Authorities in the Olifants river basin



Source: Lefebvre (2005) from IWMI database

6. Results

6.1. Domestic water institutions in the former homelands of the Olifants river basin: from theory to reality

The present domestic water institutions in the study area shows differences and, somehow, simplification compared to the organisation planned by the legislation. No private Water Services Providers are contracted in the study area. Water is mainly provided by public entities at national (DWAF), provincial (Water Boards) and local levels (Municipalities). Consulting firms, which were not explicitly identified in the national framework, compensate for lack of capacities at all levels. They actually play an important part in shaping provincial and local government decisions (Webster 1999), especially in the former homelands where municipal capacity is quite poor.

Water Services Authorities appear not to shoulder the full responsibilities inherent in their function. Indeed, local municipalities and water boards apply tariffs without referring to the WSA in charge in the considered area. The important backlog inherited from the apartheid and the fact that water laws and local governments were only recently created can explain this gap between theory and reality. However, it is important to notice that the present situation is likely to change in the near future. Indeed, DWAF is transferring its schemes and responsibilities in term of water and sanitation services provision and should soon retire from the water services sector as services provider. Moreover, all WSAs are in the process of identifying their future water services providers. It is not clear whether local municipalities that presently perform water services provision function, will remain water services providers, particularly since some WSAs see these local municipalities' activities as an encroachment on their responsibilities. The situation is also complex for Water Boards. Three Water Boards play a part in the study area but it seems that their future development could differ. Indeed, Lepelle Northern Water, the most important water board in the area, will probably become part of a public-private partnership with WSAs while the others may disappear.

6.2. Diversity of water supply networks and costs: what are the determinants?

A short technical description of the schemes in the study area can be drawn. The average age of schemes in our sample ranges from 5 to 23 years. However, 55% of the schemes are between 9 and 12 years old, which approximately correspond to the end of the apartheid (1994). More than 45% of schemes (precisely 31) supply a population between 50000 and 100000 inhabitants. The average consumption is 36 L/person/day, which is above the standard of 25L/person/day[11]. However, it can vary a lot: the maximum consumption is 124 L/person/day and the minimum 10 L/person/day (with a standard deviation of 30 L/person/day). The water is mainly extracted from groundwater (66% of schemes) and for the most part is supplied via hand-powered boreholes (54% of boreholes are hand-powered, 22% diesel-powered and 21% electrical). The storage capacity of these schemes varies from 0 to 0.843 m^3/capita, with an average of 0.132 m^3/capita. However, all the capacity is not used. The non-used storage capacity varies from 0 to 64% of the total storage capacity, with an average of 27%. This gap can be explained by the lack of maintenance, which led to degradation of infrastructures. Only 24% of networks have a water treatment work, and only 15% are equipped with a sewage treatment work.

A typology of these networks in four groups was built using the results of a Principal Component Analysis (PCA) based on technical characteristics[12] (costs variables were kept as illustrative[13]):

- The first group comprises two large schemes, with a large of population, a high storage capacity per capita, and a number of pumping stations and of sewage treatment infrastructures above the general mean.
- The second group (15 schemes) is characterised by a relative youth, an amount of water delivered per person above the mean, a higher proportion of diesel pumps, and a higher storage capacity per person, all reflecting a higher level of service. This group is also characterised by higher replacement, refurbishment and maintenance cost per capita and present value per capita.
- The age of schemes and the proportion of hand-powered boreholes, both above the general means, distinguish the third group (10 schemes), which also generates lower costs.
- The last and largest group (39 schemes) is characterised by a high proportion of hand-powered boreholes, a lower water delivery per capita, and their youth. They also have significantly lower costs. These networks, which use simple technologies, may have been built just at the end of the apartheid to rapidly supply water to people who were not previously served.

Costs per capita are highly variable across schemes (Table 1). Indeed, each type of cost presents a standard deviation of the same order as the mean value. Groups 3 and 4, which gather the most rudimentary networks have the lowest costs. Group 3 schemes, which are the oldest, seem also to be the cheapest, even when compared with group 4. The T-test confirms the significance of mean differences between group 2 and group 3 and between

[11] Due to the generalised absence of water meter, what we call water consumption most certainly corresponds to the volume of water, which is delivered in the whole network (i.e., including water losses, which may vary according to the state of the infrastructure and the level of maintenance) and not necessarily what users consume. Therefore, this is only a proxy for water service level.

[12] The technical characteristics used were: number of people served, average age of the scheme, storage capacity per capita, percentage of hand-powered boreholes, percentage of diesel powered boreholes, and the water delivery par person and per day.

[13] All costs used in this analysis were estimated and calculated costs provided by DWAF.

group 2 and group 4 (except for refurbishment costs). However, only the present value and operating costs are significantly different between group 3 and group 4[14].

Table 1 – Means and standard deviations of networks' costs per person (2003)

	Present Value (*R/person*)*	Replacement cost (*R/person*)	Refurbishment cost (*R/person*)	Maintenance cost (*R/person*)	Operating cost (*R/person*)
General mean	R 346	R 476	R 41	R 12	R 18
General standard deviation	R 320	R 380	R 45	R 8	R 19
Group 2 mean	R 648	R 836	R 64	R 19	R34
Group 3 mean	R 150	R 255	R 47	R 7	R 7
Group 4 mean	R 268	R 379	R 31	R 10	R 14

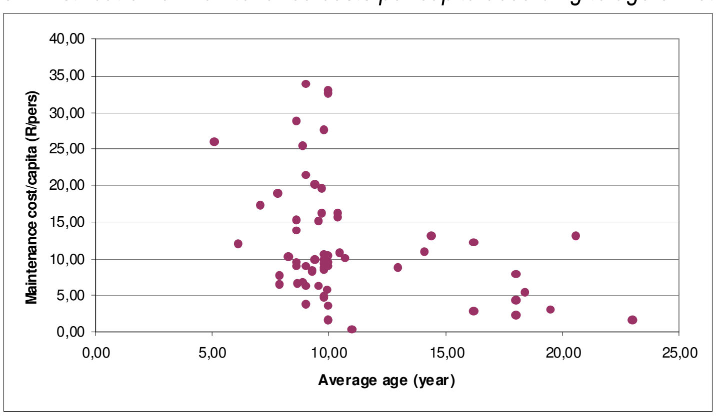
* In 2003, the average exchange rate between South African Rand and US Dollar was R 1 = USD 0.133

(Source: own calculation from DWAF Functional Assessment data)

The analysis of the effect on costs of technical characteristics, when considered individually, shows disappointing or unexpected results. For example, no economy of scale has been revealed, probably because of the high heterogeneity of the sample networks, and also because, schemes, which are presented by DWAF as stand-alone infrastructures are in reality composed of different networks.

Contrary to expectations costs of recently build networks seem to be higher than for older schemes (see Figure 5 for maintenance costs[15]). However, this apparent trend is not significant, as the sample comprises a large proportion of schemes aged 9 to 12 years, with a high variability of costs, probably due to different types of technologies.

Figure 5 – Distribution of maintenance costs per capita according to age of networks



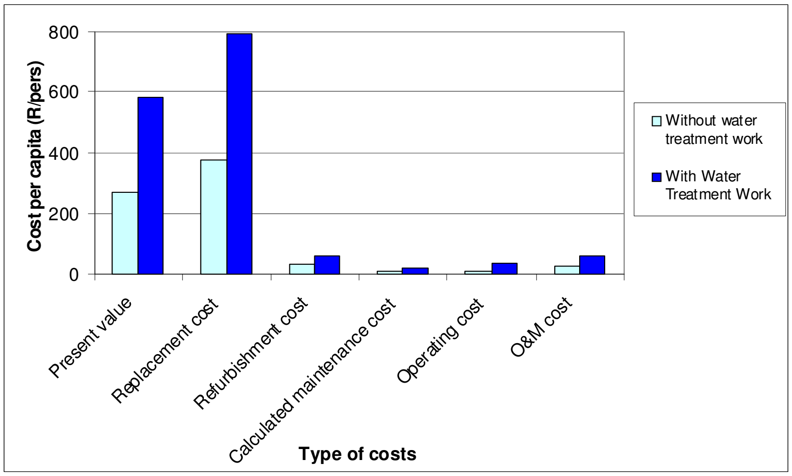
Source: Lefebvre, 2005 from DWAF Functional Assessment, 2003

On the opposite, as expected, the presence of water treatment has a significant effect on water supply costs (Figure 6) The difference of mean values between the two groups (with and without water treatment is confirmed by a T-test, except for refurbishment costs, which are more related to the level of degradation of the infrastructure.

[14] Group 1 schemes were not compared to other groups because of the low number of networks in this group.

[15] Distribution of all other costs presents the same shape

Figure 6 - Distribution of mean costs according to water treatment



Source: Lefebvre 2005 from DWAF Functional Assessment, 2003

6.3. Do WSAs water pricing policies fulfill their objectives?

The analysis of water pricing policies requires getting financial data on water supply services, which is not easy in the newly built municipalities. Indeed, specific accounting systems for domestic water are rarely in place and relevant information are scattered in several municipal accounts. Some of the costs (e.g., personal costs) are even still born by DWAF.

Water pricing policies in our study area are quite heterogeneous (Table 2) and range from the most complicated to the simplest. Nonetheless, some WSAs are still drawing and submitting their water services pricing policy, which can explain the no tariff system in effect. It is also interesting to note that while the WSA is responsible for implementing tariffs in its area of jurisdiction, some local municipalities (when the WSA is a District Municipality[16]) apply their own tariffs in very localised areas (in general small former white towns). Similarly, Water Boards have implemented in rural area a specific pre-paid system for each village.

We can distinguish three pricing systems:

- The no tariff system is obviously the simplest and less expensive to implement, but it limits the source of funding for services, as all the costs have to be covered by national or local government subsidies. Moreover it raises the question of equity first because, due to the diversity of technologies used to provide water (see analysis of networks above), the level of services is likely to vary a lot within the WSA jurisdiction, and second, in a same WSA, some users may be charged or not for water depending on the services provider.
- A flat rate is used by two WSAs. The tariff seems rather high compared to the average level of income and experiences elsewhere. Indeed in cases of successful cost recovery systems in rural communities (DWAF 1998), flat rates ranged from R1.4 to R15/month/household. Moreover, this tariff does not take into account the level of services.
- Polokwane LM pricing system differentiates the tariffs according to the volume consumed. It also differentiates between locations, rural tariffs being lower than urban

[16] There are two levels of local governments in South Africa, District Municipalities (DM) and Local Municipalities (LM), with theoretically different functions. According to circumstances the WSA may be either a DM or a LM.

tariffs, probably to reflect different levels of services. The lowest-income households receive a municipal grant of R100 per month to help them paying for basic services. This system requires obviously more information on the population served and is more costly to implement (targeting of subsidised households and metering of water consumption).

Table 2 - Diversity of water tariff structures applied in the WSAs of the study area

WSA	Current water tariff and direct subsidy
Capricorn DM	*No tariff*
Bohlabela DM	*No tariff* (except in one former white town)
Sekhukhune DM	*No tariff* except a pre-paid tariff applied by Lepelle Northern Water and some Local Municipalities in former white areas
Dr J.S. Moroka LM	*No tariff*, except for 17% of the population (in town) who are charged a global amount of R 50/month/household for water, electricity and refuse removal
Thembisile LM	*Flat rate*: R25/month/household

Polokwane LM	*Complex increasing block tariff and targeted individual subsidy*:
	- First step consumption < 5 m^3/month: R 2.07/m^3/month
	- Second Step consumption between 5 m^3 and 100 m^3:
	  - in urban areas: R 4.5/m^3/month
	  - in semi-urban areas: R 3.8/m^3/month
	  - in rural areas: R 3.2/m^3/month
	- Third Step: consumption over 100 m^3: R 5.82/m^3/month

	R100 monthly grant to indigent households for all basic services

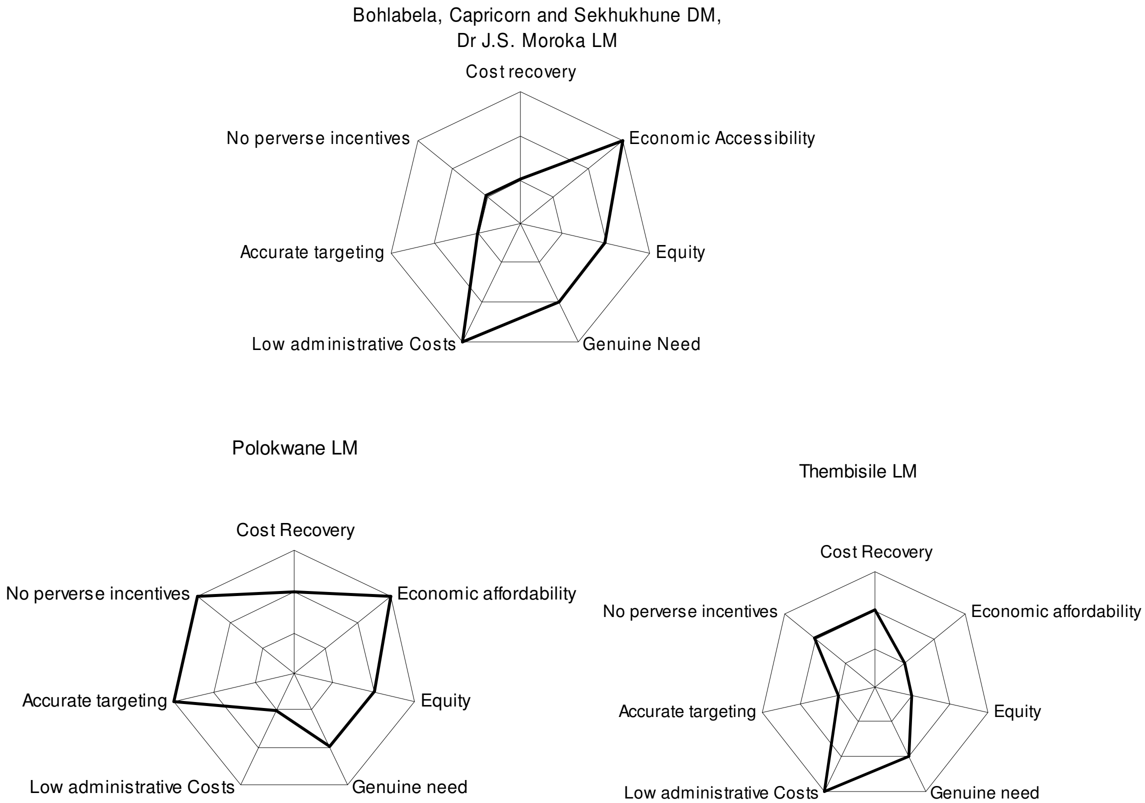
As underlined previously, water-pricing policies cannot be analysed without considering the importance and type of subsidies. The Equitable Share (ES) and the Municipal Infrastructure Grant are the two main sources of national subsidies. Even if the total amount of each subsidy is available in municipal accounts, it remains difficult to know precisely the amount dedicated to water and the way it is used. The ES represents only a little part of total national subsidies (37% at most). In fact, as municipalities are free to choose how to use it, a very small part seems to go to water services provision. Furthermore, the amount received by each WSA varies a lot (from R3 to R42/inhabitant/year for ES; and from R32 to R149/inhabitant/year[17]). However, in WSAs where water is not priced, the rest of water services costs should be covered by the general municipal budget, which can be limited by the lack of revenue-raising economic activities. This situation entails a risk of low sustainability of existing schemes and limits the scope for new infrastructure development.

From informations gathered and using the objectives of water pricing and subsidy policies presented in section 4 above, it is possible to assess the water services policies encountered in the study area (Figure 7). Economic affordability was rated by comparing the average water bill and the distribution of income across households in the area (using Census data). Equity was appreciated qualitatively by comparing the level of water access and the water bill. Genuine need refers to the ability to pay appreciated through the level of income. For cost recovery we compared the revenue from water bill to the total costs of water services. The three last criteria are straightforward[18]. This analysis remains highly qualitative due to the reliability of data collected and results should be considered cautiously.

[17] The amount of ES transferred to local governments by National Treasury depends on the proportion of indigent households in the area, while the amount of MIG is related to infrastructure projects. Therefore this variability reflects the diversity of socio-economic context and development strategy of the municipalities.

[18] “Economic efficiency” and “resource conservation” have not been represented, due to lack of relevant data.

Figure 7 - Evaluation of water services pricing and subsidy policies in the surveyed WSAs



To summarise, three types of water pricing policies can be identified. The most common (used in Bohlabela, Sekhukhune, Capricorn DM and Dr JS Moroka LM) prioritises the simplicity of the policy and the objectives of affordability and low administrative costs probably to the detriment of economic efficiency and sustainability, which may create problems in the future. Thembisile LM policy tries to reach a higher level of cost-recovery but to the detriment of equity and affordability. Finally, Polokwane LM policy aims at reconciling various objectives, but is only possible because of the presence of high-income population, which allows cross-subsidies, and revenue-raising activities[19].

7. Conclusion

The South African constitution imposes on governments to provide all inhabitants with a minimum level of water services. In rural and poor urban areas, the huge backlog in terms of water supply and sanitation inherited from the apartheid constitutes therefore a real challenge for the newly born local governments in charge of water services provision. The domestic water sector in South Africa is characterised by institutional uncertainties due to on-going transition between national and local governments. From what we have observed, the present situation may raise some concerns about the real participation of communities in the planning and decision-making process regarding water services, and furthermore in the day-to-day management of the networks, although it is explicitly considered in the Water Services Act. Considering the geographical extension of WSAs, an intermediate level between WSA and end-users may be needed, but the role of WUAs in this respect is still not very clear.

[19] Polokwane is the capital of the Limpopo province and therefore has a population structure and level of economic development noticeably different from other municipalities in the study area.

Our study shows a technical heterogeneity of water supply schemes at local level, specifically in terms of level of service measured by volume of water delivered per person. Linked to technology diversity is the high variability of costs without clear scale effect and age dependency.

The most frequent pricing policy is a no-pricing policy, which raises concerns about cost recovery and financial sustainability of water services, although the average operation and maintenance costs remains affordable (R30/pers/year i.e. R15/household/month) for households earning more than R300 a month. Operation and maintenance costs for less than 25L/pers/day are even more affordable (R15/pers/year i.e. R7.5/household/month). Experiences of more sophisticated pricing-subsidy systems (e.g. Polokwane LM), which try to address several objectives, need to be monitored and assessed. At present they are not likely to expand due to their complexity and cost of implementation and the general lack of capacities at WSA level. Generally, the domestic water sector in poor rural areas is characterised by a high level of subsidisation, consistent with the free basic water policy. However the subsidisation sometimes goes beyond this basic level (no pricing for networks that provide more than the basic volume), which may lead to inequity of access and charging.

Besides the pricing policies, concerns about sustainability of networks after their handover to WSAs are nurtured by the lack of technical capacities, the lack of proper accounting system and financial management, and the poor capacity of WSAs to raise revenue to cover the costs of water services provision, which is not fully compensated by subsidies from national government[20]. This entails a risk of initiating the vicious circle of poor cost recovery – poor maintenance – poor quality of service – poor willingness to pay.

From our study, higher volume delivered per person seems to be related to higher costs of provision. However available data are not sufficient to assess if a higher volume of water supply is inducing more productive uses of water in the study area. It can also correspond to a higher use of water for domestic purpose (e.g., increased hygiene).

The development issue formulated in the title of this paper "Is it possible to design water pricing and subsidy system to ensure equitable and efficient provision of water for multiple uses in rural poor areas of South Africa?" can be translated into several research questions: i) what is the willingness to pay of water users in rural areas? ii) what are the costs of water provision for different level of services? What are the methods to collect primary data on costs? iii) Can multiple use systems be implemented for which uses and categories of users, in which locations? Answering the first question requires an analysis of water demand at household level (such as Banda *et al.* 2004). The present paper provides only partial answers to the second question for the domestic sector and needs to be completed by an analysis of the irrigation sector. Finally, further research is required and planned within the MUS project to fully address the last one.

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[20] The ES is sufficient to cover operation and maintenance costs of delivering less than 25L/pers/day but covers only 60% of average operation and maintenance costs. Since there is most often no water pricing, 40% of costs must come from the general budget of the municipality.

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