Water Demand Management, Natural Resource Reconstruction and Social Adaptive Capacity: A Case Study from Kolomo, Zambia

Paper presented at the WARFSA/Waternet Symposium
"Integrated Water Resource Management: Theory, Practice, Cases"
Cape Town 30-31 October 2001

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Introduction

The African Water Issues Research Unit (AWIRU) at the University of Pretoria and the National Institute for Scientific and Industrial Research (NISIR) in Zambia are jointly executing a project on Water Demand Management (see Turton *et al.,* 2000). The project aims at understanding the various social components in the principle of "Adaptive Capacity" and "Natural Resource Reconstruction". Adaptive Capacity refers to the ability of a social entity to adapt to changes in its environment in order to survive (Turton, 1999; Turton & Ohlsson, 1999). Natural Resource Reconstruction is a condition whereby the natural resource-base (water) is being rehabilitated (Allan & Karshenas, 1996:127-8), and is taken as a proxy indicator for sustainability. The research project is being funded by WARFSA and is located at eight different research sites in two different countries (Botswana and Zambia). This paper refers to the preliminary findings from Kolomo in Zambia, which is one of these research sites.

Physical Characteristics

Zambia is located between latitudes 8 to 18 degrees South of the Equator and Longitudes 22 to 33.5 degrees East of the Greenwich Meridian. With a total land area in excess of 752,000 km^2, the country lies on the great African plateau and is generally flat with hills in the extreme North East and the escarpments in the South dividing the Luangwa and Zambezi river valleys from the plateau. The average height is between 900 to 1,400 metres above sea level. Four major rivers drain Zambia - the Luapula/Chambeshi in the North form part of the Congo River Basin; while the Luangwa in the East, Kafue and the Zambezi traverse the Western and Southern parts of the country forming part of the Zambezi River Basin. The Congo - Zambezi Watershed separates the two river systems from each other. Zambia has a seasonal rainfall that comes in summer between the months of October and March, with precipitation decreasing from North to South, and from East to West. The Northern parts receive an average of between 1,000mm to 1,200mm of rainfall annually. The central parts receive between 800mm to 1,000mm while the rain shadow areas covering major river valleys receive precipitation of between 500mm to about 900mm annually.

Kalomo is located in the Southern Province of Zambia and receives an unpredictable rainfall towards the end of October that rarely exceeds 800mm/a, making farming a risky business. With a total area of 15,000 km^2, Kalomo has a population of 143,000 people according to the 1998 estimates. The District is estimated to have about 35,000 households of which about 70% live under conditions of poverty. At least 97% of the population is engaged in agriculture on the sandy-loam soils, which support the growing of maize, tobacco, sunflower and groundnuts. Cotton, fruit and vegetables are also grown in parts of the district. There are three constituencies (Mapatizya, Kalomo and Dundumwenzi) under four traditional rulers (Chiefs Sipatunyana, Simwatachela, Siachitema and Chikanta). Kalomo lies astride the Great North Road 120-km north of Livingstone and about 400-km south of Lusaka. A linear settlement pattern is observed along the road and rail transport routes that pass through the district. Towns such as Zimba and Kalomo lie along these transport routes and are typical of Zambian urban settlements along the line of rail. With an average population density of about 8.6 persons per km^2, Kalomo is sparsely populated.

Sources of Water

The major sources of raw water for the Kalomo township supply are from dams. These include the Railways and Williams Dams from which raw water is pumped to the treatment plant in Kalomo town. The Railways Dam was constructed in the 1940s to supply water to the railway compound. The dam wall is concrete with a height of about 127.5metres, but siltation has reduced the storage capacity considerably. Williams Dam was constructed in 1953 by a local farmer for irrigation purposes and is an earth dam with a concrete spillway. This dam was connected to the Municipal water supply scheme in 1986 under a World Bank assistance project, while rehabilitation of an electro-mechanical system at the intake was done in 1995 through an African Development Bank (ADB) loan. The dam has since lost its holding capacity due to the collapse of the wall. The low storage and loss of capacity of the two dams has adversely affected the Kalomo township water supply. Five boreholes were drilled in order to augment supply, but these are inadequate. Treatment of water is limited, as the two treatment plants are not fully functional. The railways treatment plant, consisting of a pressure filter, was built in the 1950s, but has not been operational since 1991 due to lack of maintenance and spares. The other treatment plant consisting of two settling tanks, six slow sand filters and two clear water reservoirs was constructed in 1974 by the Department of Water Affairs (DWA) with rehabilitation programs in 1986 and 1995 with ADB loans This is a modern and conventional slow sand filtration system. Treated water is stored in raised reservoirs with a total capacity of 1,785 m^3 with a daily demand of up to 1,942 m^3. Government estimates show that about 4,205 inhabitants of a total population of 12,773 were being serviced in 1996. The remaining 8,568 people found in informal settlements such as Mawaya, Magrimondi and Bridge Compound are dependent on public standpipes. It is estimated that on average, about 428 people share one standpipe.

Daily water consumption is around 971 m^3, but losses account for more than 50%. This has resulted in the general daily water demand being estimated at about 1,942 m^3.

However, the treatment plant capacity is only 3,000 m^3/d with frequent breakdowns. This means that water rationing is commonplace and that induced scarcity is endemic. Sources of raw water for the rest of the population are in the form of dams, streams, rivers, boreholes, shallow wells and dambos. These sources are mostly unreliable and are prone to disease and desiccation. A number of NGOs are operating in the area, mostly involved in development programs related to water supply and sanitation. The period between 1991 and 1996 saw a prolonged drought in the Kalomo area, resulting in the dropping of ground water levels. A large portion of the District lost access to reliable water sources at this time and poverty is increasing as a result. People walk long distances to fetch water. At one time, children as young as five years covered distances of 15-km in order to fetch water. According to the 1995 survey done by the Community Management and Monitoring Unit (CMMU) of the Water and Sanitation Sector Reforms, of the 299 water points for rural water supply, 110 were not working due to various reasons.

Collection of Data

The data gathering in Kalomo took place between 7 - 15 March 2001 and involved all 5 members of the team under the leadership of the Local Research Partner (LRP). The team was accompanied by Engineer Cledwin Mulambo, the Senior Engineer responsible for water and sanitation at the Ministry of Local Government and Housing. This followed a pledge of support received from Government to assist in the provision of vital logistics for the duration of the data collection phase. The Permanent Secretary wrote letters to the District Administrators in the respective districts. In support of this, the LRP wrote letters directly to all of the stakeholders in the project areas to indicate the start of the data-gathering phase.

The team started gathering data from various settlements in Kalomo, followed by Zimba 40-km to the South. Three unplanned settlements were polled - two in Kalomo town (Mawaya and Magrimondi) and one in Zimba (Mawaya Zimba). In addition to this, another three settlements were polled - Green Acres and Mwaata, consisting of medium cost houses, and Boma consisting of a combination of low, medium and high cost houses. In all cases data was collected by using a questionnaire with a target of 220 questionnaires in total. The Enumerators interviewed the respondents and their responses were recorded on the questionnaires. The categories of the respondents were broken into what was knows as Supplier (with a target of 200), User (with a target of 20) and Other**.** Entry into the communities was first established through the community leadership. As indicated earlier, letters were written to the District Administrator and the Council Secretary in order to introduce the team and its programme. On arrival in the field, meetings with the District Administrator and later with the Local Authority leadership were held. Community leaders such as Water Point Chairpersons were also briefed before the data gathering exercise was commenced. A general walk through each of the communities was first executed in order to establish some conceptual map of the area in question as no formal maps existed. Any special features of an area were noted. The research team then went out into the field to an arbitrarily selected starting point and fanned out individually along a determined straight line sampling and interviewing households. Where possible, selecting every 5th household for sampling ensured

randomness, but this was not always practical. The team also held focus group discussions where qualitative data was gathered as relevant. Any spontaneous data that was collected was noted on the back of the questionnaire sheet while other details were recorded in notebooks brought by the team for the purpose. During the evening the whole team met to discuss the findings for the day and to engage in planning for the next day. Preliminary data cleaning was first done by the Enumerators and later by the LRP while still in the field. Subsequently the data was evaluated by the LRP using simple scatter scores and percentages of the responses. The original data sheets are being stored as they contain a wealth of information that can be relevant to subsequent research projects.

Preliminary Findings: Responses by "Users"

Most people (58%) in the area do not use public standpipes. This can be explained by the fact that this is mainly a rural setting where most water is supplied through boreholes fitted with hand pumps. People do not regard these as being standpipes. Most people (59.5%) do not have metered connections. Most houses are either not metered, or the meters are not working. This is causing concern to the Users whose willingness to pay has been greatly affected by this factor. A significant number of people (37.2%) served by the Commercial Utility have alternative supplies that range from streams, rivers shallow wells, dams and boreholes. These alternatives are mainly used during interruptions of supply from the Utility, which is under severe pressure caused by limitations to the treatment and storage capacity noted above. Many people (50.6%) supplied by the Commercial Utility receive regular bills for their water at monthly intervals (96.78%). Most of those who do not receive bills are individuals supplied by the Commercial Utility through a “cash and supply” system where water is paid for at the time of drawing it at the supply kiosks.

Price was seen by most (65.7%) to be a sufficient incentive to manage water demand. However a significant number (33.5%) indicated that price in itself may not work. Their reasons for this assertion ranged from indicating that those with money could continue to waste water even if they paid for it, and demand could still be high because of carelessness on the part of the consumers. **It was proposed by some that education and not price might work better.** A number of people (49.3%) indicated that they do not receive monthly bills as they paid cash on drawing the water at the kiosk, or paid for water rights every three years to Government. Some said they received free water from the Commercial Utility as employees of the same company or that they belonged to a Water Point Committee, which collected cash from the Users. These were mainly the borehole-supplied Users in the villages. This indicates an element of corruption that undermines both the sustainability and the integrity of the whole system.

When asked about the fairness of the system of paying for water, most respondents (55%) felt that it was fair. For those that considered the system to be unfair, the major reason given was the fact that those on fixed rates felt that they were being cheated by the Utility. Others said that they would only consider the system to be fair if the water supplied was of good quality. **A small but significant group in one of the localities (Mawaya Zimba) said payments being made were not being receipted** and that the

community was not being consulted on matters of adjustments in tariffs. A supply of only one water point to about 5,000 residents who are each asked to pay K8,000 per month was said to be very unfair, and an increase in the number of water points was suggested to resolve this problem.

Significantly, **the majority of respondents (64%) said they were willing to pay more for water if the supply was more convenient and accessible to them**, especially if brought closer to them. The Users ready to pay more for the service also indicated that they would pay between K1,000 - K6,000 per month (K3,500 = US$1). Most institutions pay between K250, 000 to K1,600,000 per month (K3,500 = US$1).

Most of the respondents (68%) clearly indicated that the current service was unreliable. The biggest complaint on service reliability was that water is being rationed. Most respondents echoed this sentiment. The dissatisfaction with the reliability also touched on the issue of Kiosk Operators (water vendors working for the Commercial Utility) who are not available when needed. A common sentiment was the desire for water supply connections to individual houses in order to reduce walking long distances, in addition to an increase in the number of water points and boreholes. The quality of water was another issue of concern as the Users felt that dirty water was a danger to their health. **Most respondents (60%) were dissatisfied with the quality of the water**. To resolve this problem, a common suggestion was that water needs to be treated, while some said there is a need for education to all, including the Supplier.

Most of the respondents (88%) indicated that they are not satisfied with the amount and type of information that they are given at present by the Supplier, and the need that the Utility should improve its dissemination of information to Users was often articulated. The dissatisfied Users suggested several remedies to improve the situation. These included the use of a public awareness program such as a Public Address System to provide information to the community; the holding of meetings with Users; consultations with the community on matters of common interest; the use of publications such as brochures and regular community visits by the Utility to listen to the concerns of the Users. Significantly, the Suppliers did not mirror this sentiment.

The majority of respondents (80.5%) exhibited an awareness that there is a cost attached to the supply of water. Most (90%) also suggested that Users want a combination of the Government or Commercial Utility to bear the cost of supplying water. **Regarding water charges, 53.4% said that they were fair and reasonable.** Some of the reasons advanced for the unfairness of the charges included assertions that water should flow 24 hours a day in order to attract such high bills as the consumers are merely paying for wind. In order to satisfy them, these consumers demanded that charges should be reduced from the current K10.00 per 20 litres from kiosks or K8,000 per month (K3,500 = US$1) for public stand pipes, to something lower. **The disgruntled consumers also indicated that there is a need to meter their supply so that they only pay for what they consume.** The provision of subsidized water to the poor and consultations with the community were also suggested as measures to enhance fairness.

Only 37.5% of the respondents were satisfied with the current levels of accessibility. The dissatisfied group said that in order to rectify this water should either flow continuously, or that the rationing should stop. Others said that the number of kiosks, standpipes and boreholes should be increased. This was evident in one of the townships (Mawaya Zimba) where about 5,000 households use one standpipe for their supply. The provision of clean water, own house connections and the bringing of water closer to home (some walked at least 3-km to fetch water) were also highlighted. Most walked more than twenty paces but less than 3-km to fetch water, which was done three times in a day as the average frequency of drawing water.

Typical of any Southern African situation, men rarely drew water. This was left to the women and children to do. It was usually the unmarried men that drew their own water. The water is commonly stored in 20 litre plastic containers and rarely in buckets, clay pots and tanks. The water was used for drinking, cooking and washing. In some instances where this was possible (distance and cost allowing), gardening was done and in very rare cases water was used for low-level types of industrial production. Though this is a very important agricultural area, most of the respondents did not own animals due to problems of diseases, or the fact that the urban setting may not allow such practices. Those with animals watered them at dams or rivers rather than at standpipes.

Most respondents (72%) said that they do not have food gardens, despite recognizing that these are important in their lives, because of the endemic water scarcity. Only 28% indicated that they had food gardens that they mostly kept during the rainy season. The irrigation of gardens was not commonly done (only 33% of respondents do this) using standpipes. Those that do irrigate noted the importance of food gardens as a source of food for the family, or as a supplement for the family income through the sale of vegetables produced. **Almost everyone had the wish to own a food garden but water scarcity was advanced as the reason for their failure.** Water scarcity can therefore be directly linked to the cycle of poverty in the region.

Only 1.4% of the respondents knew the true cost of supplying water. The cost is between K350.00 - K450.00/m^3 (K3,500 = US$1) while consumers were being charged K10.00 - K20.00 per 20 litres in the low-income areas. The respondents were generally ignorant of these facts. Significantly, this ignorance was also found in the Suppliers.

The vast majority (91%) of the people were not aware of the existence of a water conservation strategy in their area. Most (58%) said that government formulated this strategy while the remainder said it was done by the Commercial Utility. Those who were supportive of the existence of a water conservation strategy said that the major elements are stopping the wastage of water or encouraging the conservation of water and keeping water sources clean from pollution. **The majority (95%) indicated their support for such a strategy if it existed.**

Only 14% indicated that they knew what the term sustainability means. Those who said that said they knew defined the concept as the maintenance of the pipes; buying spares; the continuous running of facilities; and protection of the standpipe from

vandalism. This means that notions of sustainability can be included in an educational strategy. Water was well understood to be a scarce resource in Kalomo (79%), probably as the result of the persistent droughts in the area. This means that the population would be receptive to an education campaign. Responding to the question as to what people did when they came across a water leak, most of the respondents (98%) said that they closed the leak or reported to the Company or Commercial Utility. **This means that there is a strong sense of responsibility within the community that can be harnessed through an education campaign.**

On the original source of the water, most respondents (98%) said that it came from God and mentioned specific places such as a dam, river, rain or borehole. Regarding the ownership of water, half of the respondents (52.4%) said that this was vested in the Commercial Utility, a quarter (25.5%) said that God owned it, 13% said that nobody owned it while the rest said that they do not know. The majority (73.2%) said that the responsibility for water falls on the Commercial Utility (73.2%). When asked what roles the respondents played in the prevention of water wastage and contamination, they said that: they closed leaks; were involved in the education of the children and others to conserve water or not to pollute it; carried out hygiene education; used water economically and boiled drinking water.

Preliminary Findings: Responses by "Suppliers"

A total of 11 respondents in the group of "Suppliers" were interviewed. These were either employees of the Commercial Utility, Department of Water Affairs, the Local Authority, or NGOs involved in issues of water supply.

Concerning the cost of producing and delivering a cubic metre of water in their areas of responsibility all Suppliers interviewed (100%) did not know. However the cost paid by the Users varied between K300.00 – K500.00 per month (K3,500 = US$1) for water supplied in Villages by Village Water Committees from community boreholes, while those in Towns (urban settlements) varied between K10.00 – K20.00 for 20 litres. In the medium cost residential area consumers were paying K350.00/m^3 (K3,500 = US$1) and the high cost residential area consumers were paying K450.00/m^3 according to the Suppliers that were polled. **Investigations revealed that the true cost of supplying water is K450.00/m^3 (K3,500 = US$1) and none of the Suppliers interviewed knew this cost.** Most Users (63.6%) indicated that the tariff was applicable to all. From the comments made by the people in the area, there was confirmation that there was little being done to assist those who were poor to get access to water at a reduced cost. Those that said there were differences in tariffs also said that some consumers were on fixed charge, others were paying between K580.00 – K750.00/m^3 (K3,500 = US$1) while staff members of the Commercial Utility were being given free water. This level of cost recovery was said to be adequate to ensure sustainability by some Suppliers (45.4%). This indicates that **there is no real knowledge about the actual cost of supplying water in the area, and this may account for the lack of capacity** and erratic supply.

Most Suppliers (72.7%) indicated the existence of a water demand management (WDM) strategy in their area of responsibility. Those that said there was a WDM strategy in place gave the key elements of this strategy as: training communities in the use of water; training pump menders how to repair pumps; safe water storage; cleanliness; demand driven training; Participatory Rural Appraisals (PRAs); education to Users; leak detection and reporting/repair; educating people that the supply of water costs money; hygiene practices; the establishment of 5 new kiosks; the development of 4 more boreholes and 2 more dams. **As most of these responses focus on supply management rather than demand management, there is clearly a lack of understanding as to what constitutes a WDM strategy.** Significantly, one of the elements is education on the cost of water, where none of the Suppliers knew this figure themselves.

The majority of Suppliers (90.9%) felt that Users were willing to pay for water. The current tariff structure was said to be able to provide sufficient incentive to manage water demand in a sustainable manner by the majority (63.6%) of Suppliers. **Most Suppliers (90.9%) were aware that Users were willing to pay a higher tariff if water was made more accessible and convenient**. This is in harmony with the finding in the Users poll.

On the impact of water accessibility to the poor, **the Suppliers gave varied statements, all indicating that they are not in touch with the reality on the ground**. Some of these are as follows: It is positive in that distance is short and the cost is affordable. The cost is paid in kind by the poor. Water is not sufficient so the poor queue up. There is no scheme to cover the poor hence all pay the same price. People are opposed to payment, as there is no water. Some are forced to draw free water from Southern Water and Sewerage Company (SWSC). The very poor are exempted from paying. The community takes care of its poor people. People are able to spend time economically due to the availability of water. Poor people now have food security through gardens. The people have more time to do farming and make more money from other activities such as gardening. Abundant water means less poverty.

The number of public standpipes in various areas was found to be inadequate. It ranged between 1 - 5 in urban areas and 0 - 73 water points in rural areas. Most served vast areas of land with some people walking distances of greater than 3-km. The number of plots serviced by the Suppliers depended on the locality (urban or rural). The number ranged between 250 and 973. However, the concept of "plots" is an alien one in Zambian village communities. Perhaps terms such as "households" or "families" could have been more appropriate.

Only urban settlements in medium or high cost areas had metered connections. The existence of meters is not uniform however. In one instance 672 out of 973 plots have meters, whereas in another area 2 out of 300 plots were metered. **This is significant given the general public support for metered connections.**

Almost half of the Suppliers (45.4%) operated in an area where Users never received water bills. This is understandable in a village setting where monies were collected by the communities themselves without bills being sent out. Another element is the system of

paying for water at the time of drawing it. A monthly interval between bills was said to be the frequency with which bills are received. All metered Users were willing to pay for water as indicated by the unanimity of the Suppliers on the question (100%). **Suppliers also indicated that most metered Users actually paid for water.** The figures on this ranged between 74.4% to100% depending on the locality. **This is significant as it is supported by the poll that was done on the Users.** It therefore indicates that meters would work, but the cost of installing them makes them prohibitive.

Most Suppliers (72.7%) said that Users were sufficiently educated about all of the issues that impact on the sustainability of water supply in their areas of responsibility. Those that disagreed with this added that there was a need to launch information campaigns in order to educate the Users on the use of water. **Significantly, a large number of Users also called for an education campaign, but one that included the Suppliers as well.** In launching an educational campaign, the Suppliers named the key elements to be included. These were: the Mission statement of SWSC; the importance of water; Users education in sanitation/water maintenance; the operation and maintenance of a water supply system; hand pump maintenance; village level operation and maintenance (VLOM); the training of women masons; the safe storage of water; the need for User fees to be paid; costs of supplying water; the WASHE concept; and the conservation of water. The target audience was identified as being high density/illiteracy areas, women, V-WASHE Committees, caretakers, pump menders, domestic customers, all consumers of water, leaders like chiefs and water committees. **Most Suppliers (90.9%) claim that there is community consultation regarding aspects of water supply that affect Users directly.** Most Suppliers (81.8%) also claim that community consultation has been very successful. **This is at odds with the opinion polled from the Users.**

On the relationship between the Supplier and Users, the majority of Suppliers (72.7%) indicated that it was healthy. Some said that Users complained about the hours of operation. Some Suppliers indicated that the relationship was bad in areas where sewer lines are located as Users do not want to pay an additional 50% of water charge as sewerage fees.

Conclusion

The tentative conclusion is that water supply is under severe stress in the Kalomo area. Significantly there is a high willingness to pay, even in the face of the endemic poverty in the area. There is also a high willingness to be metered, but the costs of installing this are too high. The Users are generally unaware of the existence of a WDM strategy in the area, even though the Suppliers believe that one exists. When spoken of, the WDM strategy really focuses on supply rather than demand management, so the concept of managing demand is relatively alien in the area. Nowhere is there an understanding of the true cost of water supply, even among the actual people responsible for the supply process. These all combine to suggest that a training programme is needed before WDM can be introduced. Elements of corruption were found. These centered mostly on people who were unable to pay the full cost being asked, so they negotiated with the relevant officials who then supplied them water in return for cash that was not entered into a

receipt book. If the Suppliers could manage this better, then the income stream could be improved along with the reliability of service delivery, which is hopelessly inadequate.

Significantly, the Users polled seem to have a strong sense of justice or fairness, and they are willing to pay what they consider to be fair. There is a big gulf between the Suppliers and Users however. The Suppliers seem to think that the Users are happy with their services, whereas the Users are calling for greater communication and consultation. There is reason to believe that if this is provided, then the overall sustainability of water supply could be improved in the area. Elements of a WDM programme could include three cardinal components: pricing and the true cost of water provision; accessibility to water and the implications of that both in terms of health and in terms of the enhanced willingness to pay; and education of both the Users and the Suppliers of water.

In reality, no formal WDM strategy exists in the area, and no evidence of Natural Resource Reconstruction can be found. If anything, resource degradation is the order of the day, ranging from the over abstraction of boreholes to the leakage of untreated sewage into areas that pose a direct health risk to water resources. One of the really interesting elements of this project, is the way that the field research changed the perceptions of the Enumerators, all of whom come from various Government Ministries. In all cases, the Enumerators were initially of the opinion that Government was doing a good job before the field trip, whereas after the field trip all of the Enumerators said that their eyes had been opened to the harsh reality on the ground. This seemed to motivate them further in wanting to change things for the better, which they all pledged to do on return to their respective Ministries.

Acknowledgements

The research team gratefully acknowledges the support of WARFSA for this project. In addition to this, the various Government Departments are also thanked, along with the District Administrators and Traditional Leaders who provided the support needed for the project. Finally, the whole team is also thanked for their enthusiasm, dedication and commitment to the arduous job of conducting survey-related research in Africa.

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