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## GLOBALIZATION AND WATER RESOURCES MANAGEMENT: THE CHANGING VALUE OF WATER

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### THE COST OF WATER FOR DOMESTIC USE IN EAST AFRICA: THIRTY YEARS OF CHANGE

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**ABSTRACT:** This paper reports on the findings of a large-scale, repeat, cross-sectional study of domestic water use in East Africa, based on the landmark book *Drawers of Water* by Gilbert F. White, David J. Bradley and Anne U. White (1972). It concentrates on changes in domestic water use in rural and urban areas in Kenya, Tanzania and Uganda over 30 years (1967-1997). The results indicate that while there have been considerable improvements in some areas (e.g., uniped households doubling their per capita water use), significant decay has been evident in other (e.g., piped systems becoming over-crowded and breaking-down). This article concentrates on the initial findings on changes in cost of water for piped and uniped households in East Africa, linked to particular water sources used, collection times, distance and energy requirements to obtain water. The results show that, on average, water cost has decreased for piped households and increased for those without piped water connections. Water is significantly more expensive for uniped households, and the gap has more than doubled since 1967. Water is most expensive for uniped households in urban areas, where dependency on vendors and other private suppliers is larger. The gap between rural-urban uniped has doubled since 1967, from 30 to 60 US Cents per cubic metre (pcm).

**KEY TERMS:** Domestic Water Use, Urban Areas, Rural Areas, Water Pricing, East Africa.

#### INTRODUCTION

Ample research have been done in the past decades concerning the benefits and costs of providing a reliable, safe and convenient water supply to households in developing countries. Nevertheless, most of this research has focused on a particular locality at a particular time, and less is known about key aspects of domestic water use and its particular long-term trends. This paper reports on some of the initial findings of a large-scale, repeat, cross-sectional study of domestic water use in East Africa, based on the landmark book *Drawers of Water* by Gilbert F. White, David J. Bradley and Anne U. White (1972), which was the first large-scale assessment of domestic water use and environmental health in Africa. In 1997, a comprehensive reassessment of the initial study was launched with support from the Department for International Development, complemented with a range of formal and participatory research methods to carry out detailed historical analysis of a spectrum of rural and urban communities. *Drawers of Water II (DOW II)* has therefore tried to 'fill in the blanks' over the past three decades and chart the major trends and changes that have occurred in the domestic water and environmental health sectors in East Africa. This article in

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particular focuses on the changes in cost of water in East Africa, comparing the situation of households with and without piped water systems.

### HOUSEHOLDS WITH PIPED WATER CONNECTIONS

Households with piped water connections have different ways to pay for their water. In 1967 all piped households in the sample were paying a proportional rate based on consumption levels. In 1997 this was still a common mechanisms of collection fees in Kenya and urban households in Uganda; but block or flat rates (where households pay a flat rate irrespectively of the amount of water they consume or receive) were used by considerable larger number of households (over 90 percent of households in Tanzania).

#### The Cost of Water in 1967

During *Drawers of Water I* the average cost of water in urban centres was US\$0.77 pcm, with Uganda showing the highest value in the region (US \$0.80 pcm). Cost of water ranged from a minimum of US\$0.32 in Moshi, Tanzania, to US\$1.25 in Karuri, Kenya (see Table 1). White, Gilberth and White (1972) were not particularly surprised at the relatively high values reported, and consider that “*the direct costs to customers for piped supplies in East African cities are somewhat higher than those for cities in the United States, where the mean is about \$0.08 per cubic metre*” (US\$0.32 in 1997 values).

Table 1. Cost of Water for Households with Piped Connection (US\$ per Cubic Metre)

	1967 <sup>(1)</sup>	1997			
		SS <sup>(2)</sup>	Urban	All	Rural
			New <sup>(3)</sup>		New
Kenya	0.7	0.40	0.57	0.44	0.19
Tanzania	0.77	0.73	0.43	0.65	0.37
Uganda	0.8	0.81	0.78	0.80	--
<b>East Africa</b>	<b>0.77</b>	<b>0.64</b>	<b>0.57</b>	<b>0.63</b>	<b>0.26</b>

Notes: (1) The 1967 sample only included piped households in urban areas. Values from 1967 were converted into 1997 equivalent using the US dollar deflator due to un-reliability of similar figures in at least one of the countries; (2) SS corresponds to ‘same sites’ as in DOW I sample; (3) ‘New’ corresponds to households with piped water connections located in sites previously classified as ‘unpiped’. All direct comparisons between 1967 and 1997 are done using only the ‘Same Sites’ (SS) samples. This notes also apply for Table 2.

#### The Cost of Water in 1997

In 1997 water was less expensive in rural areas than urban areas (see Table 1). The difference is significant particularly in Kenya, with households in Kiambaa, Manyata and Mutwot paying considerably less than people in Nairobi, and the lowest values across East Africa. Water was most expensive in urban areas in Uganda, where most households were paying flat rates of even 15,000 Ugandan Shillings per month (approximately US\$14) and the service was rather poor, with few hours of water delivery during the day, meaning that households were only able to draw little water. In fact, households paying flat rates paid on average 10 US Cents per cubic metre more than those with proportional rates, and were more likely to pay higher values when water was scarce (“*paying for air*”, as some households said). Despite an average value of US\$0.58 in East Africa, the variation for this figure is quite large. Half of the households in the sample pay less than US\$0.5, while 40 percent of households pay between US\$0.5-\$1.00. The highest values (over US\$1.5) are reported Kamuli and Iganga in Uganda, and Changombe in Tanzania.

**BOX 1.** International figures for cost of water for piped households varies widely from place to place. According to information by the World Water Commission (Serageldin 1999) on a 1998 survey on water cost, values (expressed in cubic metres) in industrialized countries vary from US\$0.31 in Canada to US\$2.16 in Germany. Some values in the range are UK US\$1.28, Finland US\$0.77, United States US\$0.40-0.80, and South Africa US\$0.45. Information for 1996 values in some developing countries include: Algeria US\$0.27-\$0.57, Botswana US\$0.28-1.48, India US\$0.01-0.82, Sudan US\$0.08-0.10, Tanzania US\$0.062-0.24, and Uganda US\$0.38-0.59.

### Changes in Cost of Water 1967-1997

In real terms, cost of water has decreased since 1967 in Kenya (almost 40 percent) and Tanzania (5 percent), while in Uganda it has remain nearly the same. The remarkable change in Kenya is mostly due to a significant reduction of cost in Karuri, although all Kenyan sites also reported reductions in water costs. In Dodoma, Tanzania, households experienced a decrease of almost 60 percent in water cost, but this decrease was out-weighted by increases in Changombe and Moshi. In Iganga, Uganda, water decreased from a reported US\$0.89 to US\$0.58, but likewise it increased in Temeke and Kamuli (see figure 1).

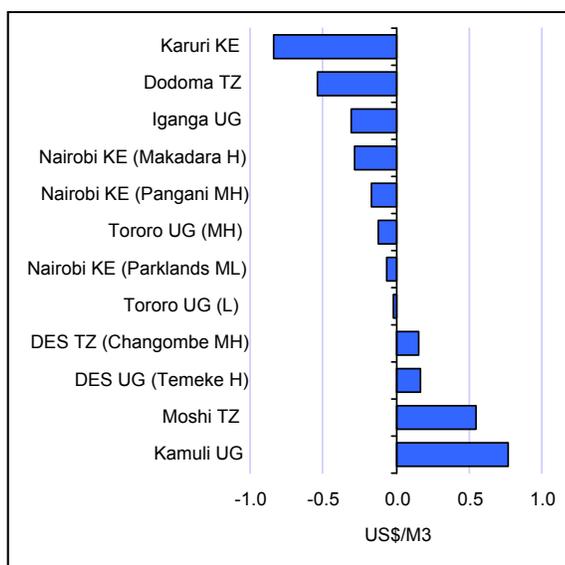


Figure 1. Direction and Magnitude of Change in Cost of Water for Piped Households, 1967-1997.  
Note: "0" represents no change in dollar value, with values less than "0" representing decreases in the cost of water and more than "0" represent increases in the cost.

### Households Without Piped Water Supply

Estimating the cost of water is a more complex situation for households without piped connections. It usually involves a direct cash price paid at the source, as well as the time and energy expended in travelling to and from the source, queuing for water and carrying it home. In addition, there is the opportunity cost of activities that individuals could be doing if they were not collecting water that could be as much as two hours per day for those drawers collecting water from kiosks.

Converting these costs into a comparable cash value is difficult. In *Drawers of Water I*, a cash value was derived by estimating the amount of energy used by each household, determining the amount of a staple food (maize) required to supply this energy and then calculating the price required to purchase that amount of food. White, Bradley and White referred to this as the 'social cost of obtaining water' (For detailed information on how the values are derived, please refer to White, Bradley and White (1972). The methodology to estimate a cash price has a number of shortcomings, making its reliability questionable. For example, the opportunity cost of time is not included, and the use of the average price of staple food masks seasonal and inter-household variation).

This method has been repeated for *Drawers of Water II* to enable direct comparison of the cost of water for piped and un piped households and the assessment of how the cost of water has changed over the past three decades. It is important to recall that while this measure might not be directly comparable with other values estimated in different studies, it still is a very useful tool to enable direct comparisons of how the cost has varied since the first *Drawers of Water* study.

**BOX 2.** Energy expenditure was estimated in terms of calories used to walk to the source (with empty buckets), waiting at the source to collect the water, and coming back home carrying loads of different weights (14, 20 and 40 kg). The gradient of land surface (going uphill or downhill) was also considered when estimating calories expenditure. Finally, one gram of maize meal (being this the basic staple in East Africa), yielding 3.5 Calories, was used as the unit of food to provide the energy requirements.

#### The Cost of Water in 1967

In 1967 the average cost of water for unpiped households in East Africa was US\$0.83 pcm. Water was approximately 30 US cents less expensive for households living in rural areas compared to those living in cities, while in 1997 and despite the fact that water cost increased both in rural and urban areas, this difference doubled in 30 years. During DOW I, water was less expensive in Uganda (both rural and urban), which is still the situation for rural households but urban households face the highest costs of East Africa.

Table 2. Average Cost of Water for Unpiped Households (US\$ per Cubic Metre)

	Rural Areas		Urban Areas			Total	
	1967*	1997 <sup>ss</sup>	1967*	1997 <sup>ss</sup>	1997 <sup>new</sup>	1967*	1997
Kenya	0.76	0.93	1.43	1.42	1.46	0.84	0.99
Tanzania	1.25	0.95	1.37	1.24	2.6	1.3	1.4
Uganda	0.52	0.71	0.68	1.45	2.5	0.57	1.3
<b>East Africa</b>	<b>0.74</b>	<b>0.84</b>	<b>1.06</b>	<b>1.41</b>	<b>2.46</b>	<b>0.82</b>	<b>1.22</b>

Note: for explanation refer to notes on Table 1.

#### The Cost of Water in 1997

During 1997, all unpiped households in the sample paid on average US\$1.22 per cubic metre of water (see Table 2). In general, water was less expensive in rural areas, where the average cost was US\$0.84 pcm, with Uganda showing the lowest values of all. At site level, the lowest value was found in Mutwot, Kenya (US\$0.16), and the highest value reported in Mukaa (US\$2.14), also in Kenya. In the first case 80 percent of households draw most of their water from nearby sources, located within a radio of 150 metres, while 60 percent of households in Mukaa walk distances of 500 m or more to get their water, therefore incurring in higher calorie-expenditure.

Water is significantly more expensive to obtain in urban areas, especially for households living in sites that were 'piped' in 1967, as many of those existing piped systems are now faulty and insufficient to cover the needs of a growing population. The average cost of water in these sites is US\$2.46, with Kenya showing the lowest value of US\$1.46. This value is affected by highly populated areas like Iganga, Uganda (US\$3.15), Changombe and Temeke in Dar es Salaam (US\$3.68 and US\$2.70, respectively). But cost of water could be a lot higher depending on availability (or lack) of options. Values as high as US\$6.53 per cubic metre were reported in Chambonge and Temeke, and Iganga reported a maximum of US\$5.5 pcm.

**BOX 3.** During the study, a great diversity of water selling activities were in operation in Temeke, Tanzania, with an equally diverse range of prices. For example, the cost of a 20-litre jerrycan ranged from Tsh10 to 400 (0.82 to 33 dollars per cubic metre). Some boreholes charged about Tsh10 per 20-litres while mosques and churches sold rainwater stored in tanks for Tsh20 per 20-litres (\$1.6 pcm). Most independent vendors operating during drought periods sold 20 litre jerrycans for Tsh100 (\$1.9 pcm). Piped households paid a flat rate of Tsh 7,980 per month (US\$13). This was considered very high, particularly given the irregular service received.

Households living in sites that have remained unpiped since the original *Drawers of Water* in 1967 face an average cost of US\$1.41, with households in Dodoma, Tanzania, showing the lowest values (US\$1.04) linked to relatively shorter collection times to standpipes, and Iganga, Uganda with the highest value (US\$1.91), showing higher collection time and the use of vendors. As it could be expected, the cost of water is highly related to the water source (see Table 3). Vendors are the most expensive water source, whose prices range from a low of US\$4.0 in urban areas that have remained unpiped, up to US\$6.4 in rural areas. The lowest cost is generally for unprotected sources, like springs or seeps, with ranges between US\$0.42 (in 'newly' unpiped urban sites) to US\$0.88 in rural areas.

Table 3. Range of Cost of Water by Type of Source, 1997 (US\$/m3)

Water source	Lowest		Highest	
	US\$/m3	Location	US\$/m3	location
Spring or seep	0.42	Urban	0.88	Rural
Well-hand pumped	0.47	Rural	1.90	Urban
Hydrant or standpipe	0.90	Rural	1.61	Urban
Vendor	4.03	Urban	6.44	Rural
Kiosk	1.21	Rural	2.47	Urban

**BOX 4.** In Tororo (a piped urban site in Uganda), the charge for piped water was 616 Sh pcm (0.6 US dollars per cubic metre). A borehole served as the alternative source for those without piped supply. However, the borehole was almost four times as expensive, a 20-litre jerrycan costing 50 Sh (\$2.3 pcm).

Change in Cost of Water: 1967-1997

The increase in the cost of water was not a general fact for all the sites in the sample (Figure 2). For example, the rural sites of Mkuu, Alemi, and Kiambaa experienced significant decreases in cost since 1967 (US\$1.4, US\$0.6 and US\$0.5 respectively). Water cost also decreased in Manyata and Masii, although is less amount, while in Mutwot and Hoey's Bridge, Kenya, it has remained almost at the same levels since 1967. Water cost, however, has significantly increased in 5 of these sites, especially in Mukaa, Kenya, where water is almost one dollar more expensive with relation to their values thirty years ago. In summary, at the regional level, the average reduction in cost (approximately US\$0.56) was not enough to compensate the average increase (approximately US\$0.63). Households living in urban areas did not have the 'luck' of some of their rural counterparts. Only in Karuri there was a significant reduction in cost of water (equivalent to US\$0.7), while Dodoma and Moshi reported a slight decrease in cost. However, Mulago, Kauli and Iganga experienced important increases in the cost of water, between half to one dollar per cubic meter.

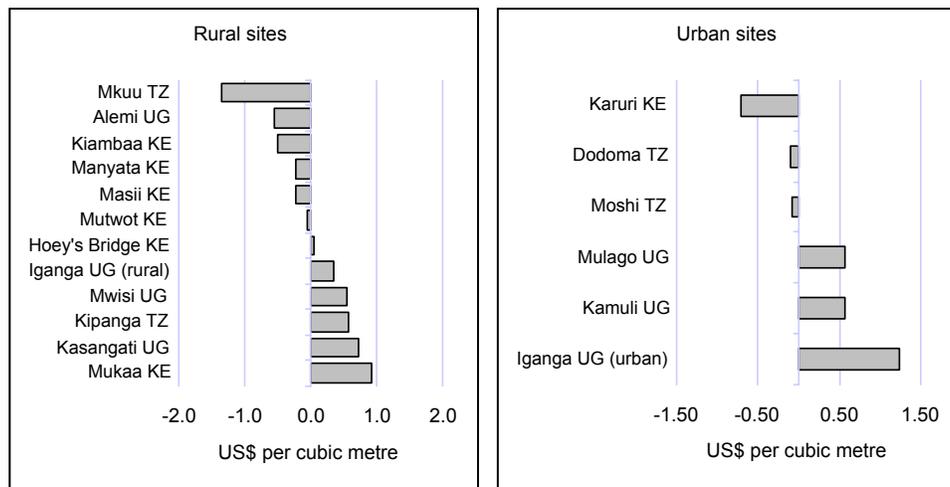


Figure 2. Magnitude and Direction of Change in Cost of Water for Unpiped sites (US\$ per cubic metre). Note: "0" represents no change in dollar value. Values less than "0" represent decreases in the cost of water and more than "0" represent increases in the cost. Magnitudes are expressed in US\$ per cubic metre. Only 'same sites' are used in the comparison.

### Piped or Unpiped: Summary

Summarizing from the previous sections, in the past 30 years the average cost of water in East Africa has increased (see Figure 3):

- ❑ increased 10 US Cents for unpiped households in rural areas
- ❑ increased 30 US Cents for unpiped households in urban areas
- ❑ decreased 13 US Cents for piped households in urban areas

In addition, the relation of cost between unpiped households in rural areas and in cities or towns increased from a difference of 30 US Cents to 60 US Cents per cubic metre, reflecting the effects of growing population in urban areas and its subsequent increase in private and expensive water suppliers.

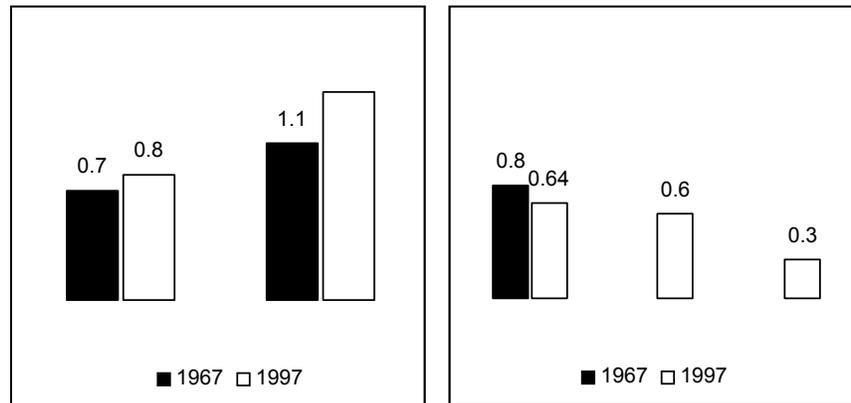


Figure 3. Summary: The change cost of water in East Africa (US\$/m<sup>3</sup>).  
Note: only same sites as in *DOW I* are compared.

The difference between average cost between unpiped and piped costs in urban areas has significantly increased since *Drawers of Water I* when water cost was on average US\$0.77 and US\$1.06 for piped and unpiped households, respectively resulting in a difference of 29 US Cents. In 1997 the gap is larger. While piped households experienced decreases in their average cost of water to US\$0.64 pcm, water cost increased for unpiped households to US\$1.41. On average, unpiped households in urban areas pay 77 US Cents pcm more than household with piped connections. This figure obviously masks other variations. For example, households who obtain water from private vendors are likely to be paying US\$3.5 pcm more than the cost of piped supply.

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