Water Resources Development, Vol. 16, No. 1, 143–154, 2000

Complementary Water Systems in Dar es Salaam, Tanzania: The Case of Water Vending

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ABSTRACT *In many cities in developing countries, a piped water supply is the norm for richer households, while poorer households struggle with a number of alternative means for accessing water. In Dar es Salaam, as the public water supply is highly deficient, households of all income classes draw upon a variety of water sources. Distribution by container using pushcarts is common in large areas, in particular where piped water is rationed, low pressure or non-existent. Tankers complement the public supply in wealthier areas. This paper focuses on how public and private systems complement one another with regards to pushcart water distribution.*

Introduction

In developing countries, the way people acquire and dispose of water varies considerably. While piped water may be the norm for richer urban households, the poorer segments of the population often struggle with a number of alternative means for accessing water. Water vending, by informal street vendors or more formal truck suppliers, is an important complement to Dar es Salaam's piped-water supply system.

The Dar es Salaam Water and Sewerage Authority (DAWASA) caters for most of the bulk supplies to the city of Dar es Salaam. However, less than half of the households receive their water directly from the utility, leaving a large part of the water distribution in private hands. Probably the most common way for households to access water is to buy from neighbours. Those with a piped-water connection or a private well often resell water to nearby households. Sometimes reselling (and water storage) is undertaken on a larger scale, and distributing vendors may come to buy water for further delivery to households and businesses.

This text focuses on distributing water vendors, who carry water in plastic jerricans loaded onto pushcarts. The purpose is to describe these largely ignored vending activities in Dar es Salaam. Problems faced by the vendors are discussed with a view towards lowering the prices to end-consumers. The empirical basis consists of a 'snowball' questionnaire survey carried out during 1998 and 1999. Interviews of about one hour, containing both closed and open-ended questions, were held with a total of 50 persons. The terms 'water vending' and 'reselling' are used interchangeably although 'vending' is more commonly utilized with relation to mobile water distributors who carry water to the

0790-0627 Print/1360-0648 On-line/00/010143–12

premises of the end-consumer. Those with connections to the public pipe-water system who sell to others are mostly referred to as 'resellers'.

Background

Dar es Salaam's Water Infrastructure

One of the age-old roles of urban governments has been to manage the urban environment, including its water systems. The infrastructural development of Dar es Salaam is still patchy, however, negatively affecting planned but densely populated areas, as well as 'unplanned' and 'squatter' settlements. It is estimated that 85% of the population live in unplanned or unserviced settlements (Kanza & Ndesamburo, 1996).

The initial water supplies for Dar es Salaam originated from shallow wells within the city, with the first water-supply system planned in 1891 (JICA, 1991). A number of expansions were carried out during the first half of the twentieth century, drawing mostly on sources within the city. The development of Ruvu River commenced in the 1950s with a plant at Upper Ruvu, some 65 km west of Dar es Salaam, which has subsequently undergone several phases of expansion and rehabilitation. The Lower Ruvu scheme, some 55 km west (or north-west) of the city, was commissioned in 1976. The capacity of the sources supplying Dar es Salaam was in 1995 estimated at 273 megalitres per day with the Lower Ruvu plant being the most important in terms of quantity (Howard Humphreys, 1995). Two-thirds of the water delivered by the Upper Ruvu system and 10–20% of that delivered by the Lower Ruvu System have been estimated to be consumed or lost by leakage along the transmission mains before reaching the reservoirs in Dar es Salaam (JICA, 1991).

In general, the primary distribution system covering Dar es Salaam is extensive and in reasonable condition (Howard Humphreys, 1995). However, the secondary distribution system is less developed, and therefore an extensive network of small diameter service lines has developed (JICA, 1991). Most of the service pipes are badly laid and riddled with bursts, leaks and substandard fittings (Howard Humphreys, 1995). Many consumers resort to pumping water directly from service lines in order to obtain water. In areas where people do not have the means to invest in pumps, many have resorted to digging holes in the ground, in order to connect to the underground service lines from below.

In an estimate by JICA (1991), about 30% of the households had house connections, 24% yard connections, and 45% had no connections (relying on water kiosks or standpipes). The registered house and yard connections accounted for 30% of the net volumes supplied, whereas only 6% of the water was delivered through standpipes/kiosks. The remainder of the water supplied went to illegal connections (29%) and leakage (30%). The number of illegal connections is estimated to be of the same order of magnitude as the legal ones—out of which some 15% are not billed (United Republic of Tanzania, 1995).

Even though Tanzania's 'free water' policy was never applied to urban areas, the urban tariffs have declined dramatically in real terms since the mid-1970s (Mashauri & Katko, 1993). Poor billing and collection, politically determined tariffs far below operating costs and a host of other problems have rendered the National Urban Water Authority (NUWA), in 1997 replaced with the more autonomous DAWASA, unable to meet Dar es Salaam's water demand.

Reselling, vending and illegal connections are examples of civil society's 'informal' response to the 'formal' service vacuum. Currently, water vending can be observed to be very common, and has also been acknowledged in more recent research. However, the rules, business practices and social organization in this area merit much deeper probing.

Water Vending in Developing Countries

Water vending tends to be an important part of the supply system in cities where pipe distribution is not able to serve all users. Resold water is usually one alternative among other sources, where the number of sources that are available to different people also depend on their ability to pay. Water markets take on a number of forms; structures differ with relation to wholesale, 'middlemen', and retail set-ups, as well as the type of equipment used. Deliveries may be hand-carried or made by tank trucks, donkey carts, pushcarts, or bicycles. There are (self-service) reselling stations (from which consumers collect water) and there are home deliveries (by distributing vendors).

Water vending is an old tradition all over the world, although fairly little thought has been given to its role in water supply. The current attention among researchers and policy makers worldwide seems to be linked to the increased interest in cost recovery and privatization. In particular, the recent proliferation of willingness-to-pay studies has increased the awareness of water vending, albeit mostly with the perspective of showing that people's ability to pay has been underestimated by water authorities.

The proportion of the population served through vendors varies enormously between different urban areas. According to Zaroff & Okun (1984) it reaches 90% in some African cities. Water vending may on average serve some 20–30% of the developing world's urban population (Briscoe, 1985, cited by Cairncross & Kinnear, 1991). While the reselling and vendor systems help serve large population groups, the reliance on vendors can also be a sign of relative deprivation and exclusion from the often higher quality piped-supply systems.

Water vending has also been considered as 'an alternative form of low-cost water supply' (Zaroff & Okun, 1984). Although vending is relatively low cost in terms of investments, the labour costs are substantial, and the service is not low cost to the consumers. Indeed, it is the price differentials between piped and vended water which have drawn most attention to these practices. Bhatia & Falkenmark (1993, p. 14) provide a long list of price differentials between prices paid to private vendors (for 'water of substandard quality') and public authorities. The ratios range from 5 (Abidjan, Ivory Coast) to 100 (Nouakchott, Mauritania).

Mashauri & Katko (1993) noted the price differentials between the publicly sold, privately resold and vended water in Morogoro, Tanzania. Households resold water for more than four times the official (public) price to domestic consumers. Water supplied to the door by vendors cost 15–25 times the official price. They remarked that "[t]he cost to resellers or vendors is really minimal compared to the revenues accruing from their sales" (Mashauri & Katko, 1993, p. 36). Nevertheless, as indicated by Shugart's (1991) review of water vending in Jakarta, and in the text below, at least vendors using manual labour are unlikely to earn a lot of money.

Water Vending in Dar es Salaam

The existence of water vending in Tanzania has been given attention by some researchers (Mashauri & Katko, 1993; Mujwahuzi, 1993; Kiilu *et al.*, 1995; Mosi, 1996). Most consultancy and donor studies of Dar es Salaam's water system, however, tend to focus on engineering or government activities, and largely ignore the important distribution channel which is constituted by informal water vending; see for example the Water and Sanitation Sector Review (United Republic of Tanzania, 1995), JICA (1991) Howard Humphreys (1995), as well as household surveys (Nagallaba *et al.*, 1993; United Republic of Tanzania, 1994; United Republic of Tanzania, 1996).

Reading official statistics, one is left to wonder: where are the vendors, who are so conspicuous on the streets of particularly western and southern Dar es Salaam? To know the true size of the water-vending markets, much more detailed and larger surveys would be required. What is currently clear, however, is that water vending provides an important livelihood for many young men in Dar es Salaam, and services a significant number of households.

Research Methods

The present study of the informal business of water vending is based on field observations, 50 structured interviews and one focus-group discussion. The first part of the survey was carried out in September/October of 1998, and the second part in July/August of 1999. Interviews in 1998 were carried out in the wards of Temeke, Miburani (Tandika), Kipawa (Kiwalani) and Buguruni (which is also where the focus group was conducted). In 1999, interviews were conducted in Ubungo, Mabibo, Manzese, Tandale, Kipawa, Yombo and Kinondoni (where the tanker trucks are found). These areas were selected because they were known (or found) to have large numbers of water vendors. The interviews, of about one hour, were carried out by the author together with research assistants from the University of Dar es Salaam.

I refer to the survey as a 'snowball' survey, meaning that there was no formalized sampling, but rather water vendors seen in the street were approached, and at other times the interviewees were introduced to us by previous respondents and on some occasions by neighbourhood officials. Formal sampling was deemed too cumbersome as the vendors all operate 'unofficially' and are not registered anywhere. Thus the sampling is by no means 'random' but could be termed 'haphazard'. Vendors placing their jerricans openly and operating throughout the day and not too far away from public means of transportation in the selected wards would have the chance (if not equal) of being included. Those approached were generally willing to be interviewed.

Of the 50 respondents, 46 were distributing vendors using pushcarts, two were tanker truck operators, and two were stationary resellers. This paper draws on the pushcart vendor interviews. Between the two fieldwork sessions the dollar exchange rate differed. There were about 670 Tanzanian shillings to a US dollar in September/October 1998 and around 760 Tanzanian shillings to a US dollar in July 1999. Nevertheless, there were no appreciable price differences between the two interview periods. Spot checks on sales prices were made to verify this. Although the dollar exchange rate has gone up further after the field

work was concluded, the average rate during the latter period (TSh760 per US$) is used where dollar equivalents are given in the text.

The Vendors

The vendors distributing water to households with pushcarts tend to be younger men with some schooling: 94% had attended primary school, and 8% had also had some secondary schooling; 8% of the vendors, however, had not completed their primary schooling. One had attended Islamic schooling (madarasa). Only three vendors (6%) had never attended school. Thus, the education level seems somewhat higher than what was recorded by Kilu *et al.* in 1995, where 28% of the sample had never attended school. This could indicate difficulties in general employment conditions, forcing better-trained people to eke a living out of water vending. Indeed, when asked about their aspirations and why they had become water vendors, the respondents invariably referred to the lack of employment opportunities. The ages ranged from 15 to 65, with the mean being just below 27 years.

In terms of ethnicity, the vendors represent a mix of the Tanzanian populace; among the 46 pushcart vendors 26 different tribes were recorded. (The most common ethnic group, six vendors altogether, consisted of 'wazaramu'—the 'indigenous' population group of the Dar es Salaam area.) Some 65% were not (yet) married, and only one of these had children. Of the 26% that were married, most had one child only, but the number of children ranged from 0 to 7, with an average of 2.75. One was divorced and two others lived with their partners without being married.

Pushcart water vendors are almost invariably men. Nevertheless, two women vendor were interviewed in the present study. (Had the sample been random, their chance of being included would have been close to nil.) While their conditions were similar to the male vendors, they are exceptional in terms of crossing gender boundaries. Most vendors (64%) were not aware of any female water vendors, and one commented: "If you see a woman pushing water you know it's for home use." That is, although women at time use pushcarts for ferrying water (it is rare though, as women generally carry water on the head), they would never be expected to sell water. In any case, the female vendors were very well respected among the male peers that knew of them.

Of the vendors interviewed, most worked from early morning until late evening. During the day, however, sales tend to be lower, and the work consists mostly in 'hanging around' (this is the time when the interviews were conducted) and 22% of the vendors were also engaged with other work besides selling water. Some of these had vegetable stands or shops that they helped with, or would take on construction work when available. It is unlikely that they would refuse to take on other cargoes on their pushcarts if requested, although, as most of them used relatively small pushcarts with bicycle tires, they would not be in a position to take on larger loads. Only a few water vendors actively sought other loads.

Most vendors (78%) had water vending as their only income. All but one were self-employed. The one employed worked for a maize mill. He would get a fixed salary of TSh15 000 per month (equivalent to US$20),and a pushcart to use for ensuring that the mill had a stable supply of water. Thereafter he could ferry as much water as he wanted and keep the proceeds of the sales himself. The

self-employed vendors tended to work independently, although they often walked with a relative or friend. In some instances, more established vendors had younger helpers.

A fifth of the vendors rented their pushcarts, and would usually pay TSh500 per day. Some expressed this as being helped by the pushcart owners, whereas others felt it to be a burden to have to pay the pushcart rent every day. Those who also rented the jerricans would pay up to TSh1000 per day for the whole set. Around a third of the vendors had started by renting, but with time had managed to buy their own pushcarts. (In some cases it was the other way around—they had started with their own pushcart, but after that had been stolen, they currently rented their transport.) Some 83% claimed to currently own their pushcarts themselves.

Accessing Water Sources

The pushcart vendors would most commonly buy their water from reselling households (76%) or parastatal organizations, generally DAWASA (22%). All of them paid for the water. The choice of main water source would mostly depend on distance (52% mentioned that it was the nearest source), and to some extent on water quality (22%) and reliability (15%). Only two mentioned price. The overwhelming majority (87%) had piped water as their primary source. The 13% that had well water as their main source operated in areas which were far from the piped distribution network. Thus, in most cases, the vendors further distribute water initially supplied by the public utility. In areas outside of the public distribution network, vendors tended to rely on private citizens who had invested in deep wells on their own premises. In some cases these water sales points were well established and even chlorinated the water.

The vendors tend to operate in areas where water is rationed, either on a daily or a weekly basis, or where piped water is altogether absent. Two-thirds relied on sources that were affected by rationing (which is circumvented as much as possible by the reselling households through the construction of large storage facilities). Vendors, as do households, thus need to have alternative sources. During the two weeks preceding the interviews, close to half had still only made use of one source, while 26% said they had drawn water from two different places, and 20% at three or more places. Apart from rationing, the main reason for interruptions seems to be power failures. This is particularly common in areas where groundwater is pumped by electricity.

Most vendors (56%) stated that there was generally no problem to get water. Those that found accessing water problematic usually mentioned 'queuing' as the main cause of the problems. Other reasons cited were 'getting wet', 'general disorder' and 'poor accessibility' where there was no rubber hose to fill the water containers. Queuing is more frequent in the mornings, and some said that you have to be sure to get to the source very early. It also seems that queuing, as the norm, was more frequent during previous years. In some of the suburban areas the water situation seems to have improved during recent years, or at least compared with 1996 and 1997 which were claimed to be 'dry years'. The improvements seemingly relate to a larger number of people having dug private wells, and selling to other households and vendors. NGOs, foreign donors and DAWASA were also engaged in sinking new deep wells. Little progress in terms of extending the pipe distribution network was noted.

Water Distribution

Probably the toughest part of a vendor's work is that of ferrying the filled pushcart to the destination. The major problem the vendors faced when getting started was the toughness of the job. Most complained of pains in the chest and joints, and very often getting sick with fever. As many start by renting their pushcarts, they cannot start slowly, but have to work full days, and after that 'you only sleep'. (One vendor deliberately worked only every other day, in order not to get too worn out.) The job is also tough on the equipment, and the next major problem is pushcart breakdowns, including punctures and warped rims. Indeed, paved roads help a lot, as pushing through sand is the toughest. Nevertheless, as the roads get better, the danger of traffic accidents increases. It seems that the pushcarts are particularly at risk.

Most carts carry six (44%), seven (21%) or eight (14%) plastic jerricans; 90% of the vendors had pushcarts with bicycle tyres. A few had motorcycle (7%) or car (4%) tyres. These can carry more: up to 20 or 30 water containers. The containers hold some 20 to 25 litres of water. A load of seven 25-litre cans weighs 175 kilos, to which must be added the weight of the (iron) pushcart itself. Thus, most vendors sell from a fixed station, and deliver water to customers when called upon.

Complaints from customers seemed not too frequent; only 9% said they often got complaints, 49% said that it happens, whereas 42% maintained that there were none. Actually, some stated that people are very grateful to get water. Nevertheless, when there are complaints, they tend to centre around the reliability of the deliveries, generally delays. It seemed that after having been given an order, the vendors sometimes ran into unforeseen problems of queuing or other difficulties of securing the water. This is one of the situations when other vendors can be helpful; several vendors stated that when somebody had an order, others could let him jump the queue, or help bring water if the pushcart broke down.

Other customers complained if the quantity supplied was insufficient. Some vendors had a smaller container that was used to top up the jerricans, and thus ensure that the customer received a completely full container. Less frequent complaints from clients related to water quality, its colour or salinity and the confidence in the safety of the source. The vendors use white (often somewhat larger, and more expensive) containers or yellow ones (originally manufactured for cooking oil). Clients preferred the white containers, as any lack of cleanliness would show more easily.

Water Quality

During my investigation, I was impressed by the awareness of water quality among the vendors. The reason may not primarily have been health, but rather commercial. Upon being asked whether they themselves drink the water that they supply, one vendor said: "Of course I have to drink my own water—how would I otherwise know that it is good?" The clients are also sensitive to the salinity level, which is an issue particularly in the southern parts. Much of the groundwater in Dar es Salaam has high salinity, often too high to suffice for drinking. The preferred water is thus that originating from the Ruvu River. Surprisingly, the 'river' water would not draw a higher price, as the prices seem

linked to the trouble of securing it, rather than the quality of the water (see below). At times, however, also the piped (river) water would be discoloured or contain particles. In such circumstances the vendors said that it was difficult to convince their customers that it was indeed piped water.

It is clear that the risks for water contamination are increased with each time of being poured into a new container. Thus, it is much harder to guarantee good quality water through a vending system than through a piped system. To exchange containers rather than pouring the water from one container to the other requires there to be confidence between the actors in the system. Only 30% of the vendors would agree to let their clients borrow their jerricans.

In Zaroff & Okun (1984) for example, the water sources used by vendors seemed to be of questionable quality, and Kiilu *et al.* (1995) recorded vendors in Dar es Salaam using both shallow wells and surface water sources. From my research, however, I have no indication of any vendor using water from inferior sources. It is easy to see that few would directly mention that if they did, and behaviour during crisis situations can also be quite different from that during normal circumstances. In any case, the vendors interviewed seemed more worried about the 'scarcity of clients' than the 'scarcity of water'.

Incomes and Expenditures

The going price for resold water was TSh20 per (about 20 litre) container (bucket or jerrican), that is, for fetching your own water using your own container, either at an 'official' DAWASA sales outlets or at a reseller. Vendors were sometimes able to secure water somewhat cheaper. Many reselling households would give 'one container free', that is, six containers could sometimes be filled for TSh100, and seven containers for TSh120. With these discounts and other variations included, the vendors' acquisition prices per (about 20 litre) container varied between TSh10 and 40; 50% paid TSh20 per container, 30% paid less, and 20% more. The resulting average litre price was just below TSh1, equivalent to about US$1.3 per cubic metre.

If there were particular problems with relation to the water supply, 75% of the pushcart vendors said that their acquisition price would increase, while 25% said it remained stable. The most commonly cited new price was TSh50 per container. The vendors were asked about the circumstances of the worst water crisis (the highest retail prices) they had experienced ($n = 37$). The purchasing prices at which they bought their water during the crisis situation mentioned ranged from TSh0 (no payment) to 150 per jerrican. Most (24%) had paid TSh50 per container, and the average purchase price increase was 92%. However, a third of the vendors had paid the same price as they usually do, and two had paid less.

The 'retail' prices for which the vendors sell water to households and other clients varied in different parts of the city. The most common sales price was TSh100 per jerrican, adhered to by 67% of the vendors. Parts of Temeke (where water is rationed by the hour) had the lowest prices, TSh70 per container, and 'regular' customers sometimes get their water for TSh50 per container. The highest prices were in areas that were farthest away from the sources. In Kiwalani, where there is no pipe infrastructure, many sold for TSh150, and in high-lying areas of Ubungo some sold for up to TSh200. In areas such as Buguruni and Manzese prices centered around TSh 100. In these areas, sources

are normally not far away, but rationing with long intervals forces vendors to walk far on certain days. The highest price ever charged by any (two) of the vendors was TSh700 per container. More commonly, 22% had charged TSh500 during extreme water shortage. (During such crises some vendors said they had left their regular areas and sold at these higher prices in the city centre.)

On (open-ended) questions about how they derived their prices most vendors, 32%, volunteered 'distance' and another 18% 'shortage' or 'scarcity'. Altogether, 66% gave some reason related to the difficulty of accessing or transporting the water they were to sell. Among the rest, reasons such as what others would charge or what would be acceptable for the customers were cited. Indeed, it seems that it is mostly the supply situation, i.e. the extent of trouble vendors have to go through to secure the water, which determines the price. If demand for the vendors' water goes down, the price does not go down but, rather, vendors abandon the market. Thus, when it rains, many customers harvest rainwater and are not interested in purchasing such large quantities as during normal days. Then, most vendors just do not operate rather than sell for a lower price.

The volume of sales is indeed difficult to assess. First, it varies a lot and seems to be more difficult for the vendors to remember than prices. Possibly, many found it to be 'mocking their destiny' to try to assess their normal sales level. Nevertheless, on average days, most vendors said they would draw water about three times per day. On 'good days', the average would be around four times, and on 'bad days,' once or twice—many would not work at all for example during rains or when there was water in the pipes in the (otherwise rationed) sales area.

Quite commonly, the vendors would fill some 18 containers (three rounds) per day, but the volumes ranged between six and 90 containers, with an average around 26. It should be kept in mind that the vendors have no bookkeeping, and discussions around earnings are fraught with different considerations, including confidentiality and possible fears of taxation. Nevertheless, a typical water vendor can have net sales of some TSh1600 per day. If the pushcart is rented, that can cost TSh500 per day, making net earnings of TSh1100 per day. Working six days per week, that is TSh6600. Allowing for weekly maintenance of the pushcart (repairs tend to be paid by the vendor, regardless of who owns the pushcart) of some TSh600, net weekly earnings can be TSh6000. Four times that is TSh24 000, which is a bit less than the current 'official' minimum monthly salary of TSh30 000 (*Guardian Reporter*, 1999; Kibanda, 1999). (TSh30 000 is close to US$40).

While the brief earnings example above is based on relatively low sales and relatively high capital costs (rent), it clearly shows that street-water vending is no money-making business. Indeed, only half of the vendors found that they could get by on what they earned, and 22% claimed that they often went to bed hungry. Another 17% said that they went to bed hungry occasionally, whereas 61% claimed always to get at least enough food. In spite of very modest earnings, as many as 66% would put some money aside for 'bad days'.

While the parallel systems for accessing water, the public pipe supply, resellers and vendors, are all interdependent, the end prices paid by consumers vary considerably. Vendor users on average pay close to TSh5 per liter (equivalent to almost US$6.5/m^3). People collecting water themselves from public standpipes or reselling neighbours tend to pay TSh0.5–1 per litre (10–20

shillings per bucket/container, or some US$0.7–1.3/m^3). Households with connections to the public water supply generally pay a flat rate for their water. The assessment on which the water bills are based has a litre price of some TSh0.3, or US$0.4/m^3 (Dar es Salaam Water and Sewerage Authority, 1998—including a tariff increase of 15% twice yearly). To connect to the municipal piped system requires the payment of a connection fee and the cost of piping. This makes it difficult for poorer households to access this cheaper source of supply.

Conclusions

Local water systems are the outcomes of the unique constellation of the public supply conditions, as given by DAWASA, voluntary initiatives by individuals and (foreign) organizations, as well as the actors on the water market. The private, commercial and community initiatives compensate for the shortcomings of the public water distribution system, and should be seen as a complement towards meeting city dwellers' demand. Vendors are most prolific in areas with insecure public supply combined with commercial activities and households with some purchasing power. Thus, in areas of lower economic status, regardless of the water supply being problematic, the potential for water vending is less. Here the (women) householders use their own labour to cater for their water needs. Nevertheless, the poorest households pay large amounts for their water as there are hardly any free sources in the city.

From a health perspective, the most efficient way of serving households is through piped connections. Water use is unlikely to increase to the level where personal and environmental hygiene needs can be fully met as long as the water used has to be carried to the house. Nevertheless, to have all households in Dar es Salaam connected to a functioning piped water system is unattainable in the near future. Thus, alternative ways of improving the water system's efficiency in serving the city dwellers needs to be found. The potential of water vending as an intermediary system was expressed by Zaroff & Okun (1984):

> The primary value of improved vending is as an interim solution for communities awaiting conventional infrastructure. The backlog of need is great and growing. Where people are presently purchasing expensive, unsafe water from vendors, and their number is large, the same system can be improved at relatively low first cost to provide lower cost, safe water until a piped system is provided. In fact, communities where people now pay for vended water are the best candidates for piped systems. (p. 295)

Thus, it should be clear that vending, as a system to be promoted, should be seen as an interim solution. The quantities that a household can afford will rarely be enough to foster good hygiene practices. Piped water supplies are actually not more expensive than vendor systems but they are more capital intensive and require more central management. Vendor systems, on the other hand, tend to be decentralized and flexible. Thus, while investment costs are low, the problem with most vending systems is the high daily expenditures for end-consumers. In Dar es Salaam, the litre price of vended water is almost 16 times that of a household pipe-water connection.

To help lower the end prices of vendor water, the water utility can assist by prioritizing a more abundant and stable supply to disadvantaged areas. The price difference between areas depends mostly on distance from water sources (i.e. time and trouble for the vendors). In many poor areas, the high vendor prices are probably a deterrent to the poorest households. If the vendor's work can be made less cumbersome, the end prices to consumers should go down. Major problems experienced by vendors—apart from distance—are poor road conditions (in particular sand). With more paved roads, water deliveries can be made easier and cheaper, although the risk of increased traffic accidents is always present. Also, end prices are lower in areas with more frequent 'on-turns' compared with areas where water is rationed with longer intervals.

Thus, a more public distribution system with more abundant public taps, more frequent 'on-turns' (or rather, no rationing altogether), and fewer leaks (causing low pressure) is the key to addressing the current inequities. Most people in Dar es Salaam would certainly welcome this, and up to some point also the vendors. A complete piped-water distribution system would of course eventually drive vendors out of business. However, there is currently great scope for improving working conditions of vendors, and thereby bettering water supply for many inhabitants of Dar es Salaam.

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