SWITCH Scientific Meeting
University of Birmingham, UK
9-10 Jan 2007

Planning urban water – dependent livelihood opportunities for the poor in Accra, Ghana

Ernest Mensah Abraham, Daan van Rooijen, Olufunke Cofie, Liqa Raschid-Sally *

International Water Management Institute
Accra, Ghana

Abstract
Ghana's capital Accra, has a resident population of about 1.6 million and an annual growth rate of 3.4 %. With a 5% poverty index, there are 90000 people earning less than 1 USD per day. The increasing demand for and use of domestic water in the city, simultaneously translates into wastewater generation. What is little known in most developing cities, and Accra is no exception, is that both domestic water and wastewater (including storm water runoff and all polluted surface water sources like city waterways), are used for multiple purposes.

Per capita domestic water supply is said to vary between 60 and 120 liters per capita per day (in the well served areas only) and 25 to 60 liters per capita per day when poor households buy water from vendors.
These same households are involved in various income generating activities requiring water such as catering, small scale food processing, water vending, small industry, and various forms of urban and peri-urban agriculture. Notably, wastewater from cities which planners traditionally see as "useless", is a potential "water resource" popularly providing water (and nutrients) for irrigated urban agriculture. These users are estimated to provide up to 90 % of the most perishable vegetable needs of the city.

The poor entrepreneur buys water for these purposes at exorbitant rates even exceeding the official water utility commercial rates. The paper presents a framework for analyzing this type of use, records the different urban livelihood activities that utilize domestic water/wastewater and quantifies such use. Constraints faced by users and opportunities to improve access are discussed. It makes preliminary recommendations for including urban water dependent livelihoods into city planning and provides insights to policy makers, planners and researchers on the wide range of 'other uses' that domestic water supply is utilized for. The role of innovative approaches like the learning alliances emerges from this discussion.

Keywords: Urban water, livelihoods, multiple uses, wastewater use

* Corresponding Author: l.raschid@cgiar.org

1 Understanding the 'unseen' resource potential

Coastal Accra is situated in the Odaw catchment, and has a population of 1.66 million (within its current administrative boundary covering 240 sq km) and a population growth rate of 3.4% annually with 1.2 to 1.6% of this accounting for rural-urban migration. Similar to many developing countries, the big city tends to attract people from rural areas in search of job opportunities and a better life. But the poverty index for Accra is 4.7% with a daily minimum wage of just under 2 USD per day (as of March 2006). In absolute numbers this amounts to almost 90,000 persons in absolute numbers.

60% of the population lives in what are known as low income settlements, and though sanitation coverage in the city is 88% with only 12% being un-served, given the poverty conditions, the predominant situation in these communities is public toilets. Only about 14% of the population in the original center of the city, is sewered and the rest is onsite sanitation (septic tanks/latrines). 22 sewage treatment plants serving institutions and hotels, but only a few are properly operated and maintained (Akuffo, 1998; EPA, 2001). These plants serve in total about 5-7% of Accra's population. The largest an up flow anaerobic sludge blanket (UASB) plant which was operating at 30% of its capacity is now broken so much of the collected sewage is discharged untreated. In the case of onsite sanitation many of these systems are poorly designed so overflows from them also commonly enter the city storm drainage canals. A small study carried out in Accra indicated that 53% of the population disposed of their grey-water directly into gutters and storm-drains, about 12% of the population throws it on the streets or outside, and 20% in their compounds (Obuobie et al., 2006). All this wastewater eventually empties into the stream and river network in and around the city, that serve as water sources for irrigated urban vegetable production. The annual volume of wastewater that is used in commercial (680 ha) and informal (60 ha) urban and peri-urban agriculture is estimated to be 4.0 and 0.4 MCM(Million Cubic Meters), respectively.

Water supply coverage to the city is said to be 80% but this does not imply a house connection. In reality only 45% of the population has a household or at best a yard connection, and this category includes the urban rich. The majority who live in the low income settlements depends on water vendors for their daily needs.

The rapid expansion of the city spatially and demographically has outpaced urban water infrastructure investments, and the water distribution network is inadequate both in terms of coverage and physical condition. The latter results in upto 30% of water being lost through leakage. The water supply company implicitly manages demand by supplying water intermittently, barring a few exceptions. Households respond by storing water for later use. Intermittent supply has also led to a thriving business of water vending, which, whilst it is a support to households without connections, also exploits the poor. These vendors 'source' their water in the urban pipe-borne network. Water vending is essentially of 2 types: large scale enterprises requiring a capital outlay for purchase of tankers that supply water in large volumes to richer households situated in water scarce neighborhoods, and small scale vendors who sell water in smaller volumes to individual households at the community level. What is interesting is that these small scale vendors mostly 'purchase' the water at domestic rates and resell it at a higher value to generate profits.

Monthly supplied water to Accra is estimated at 11.5 Million Cubic Meters (MCM) inclusive of losses in the system. Statistics on urban domestic water use give per capita water consumption that varies between 30 and 120 (source: Ghana Water Company Ltd, 2006) or 29 and 98 (source: London Economics) liters per capita per day, depending on whether it is purchased in small quantities from vendors (where use will be limited by price of water and accessibility) or obtained from an individual/household connection (when water use is more because of availability and convenience).

Under these prevailing conditions, migration into the city continues to occur exacerbating an already deficient situation. The city attracts people from rural areas because cities do offer better access to education, health care, and people believe they will have better job opportunities and a better life. However, the harsh reality is that new-comers end up with poor and insecure living standards; overcrowding, poor infrastructure, a polluted environment and a daily struggle to generate enough income. People are also inventive and flexible when seeking the means to sustain income generating activities. They seek livelihood opportunities that require a minimum capital outlay and many of these centers around servicing the material needs of people. These types of "businesses" or small scale commercial activities are not officially registered and are therefore difficult to keep a track of. Many of these are also water dependent, but what is of interest is that the water used is not paid for or recognized as commercial water. Rather it is one of the multiple uses to which urban domestic water is put. This paper is a very preliminary appraisal of the diversity, critical importance, and benefits of such use. It will also show that these types of livelihoods closely depend on small scale water vendors or purchase of water from neighborhood taps at tariffs higher than the official urban domestic water tariffs. It is suggested that constraints to and consequences of such use must therefore be recognized by city decision makes and incorporated into urban water management and planning. The need for a more comprehensive study will emerge from the analysis.

2 A framework for analysis

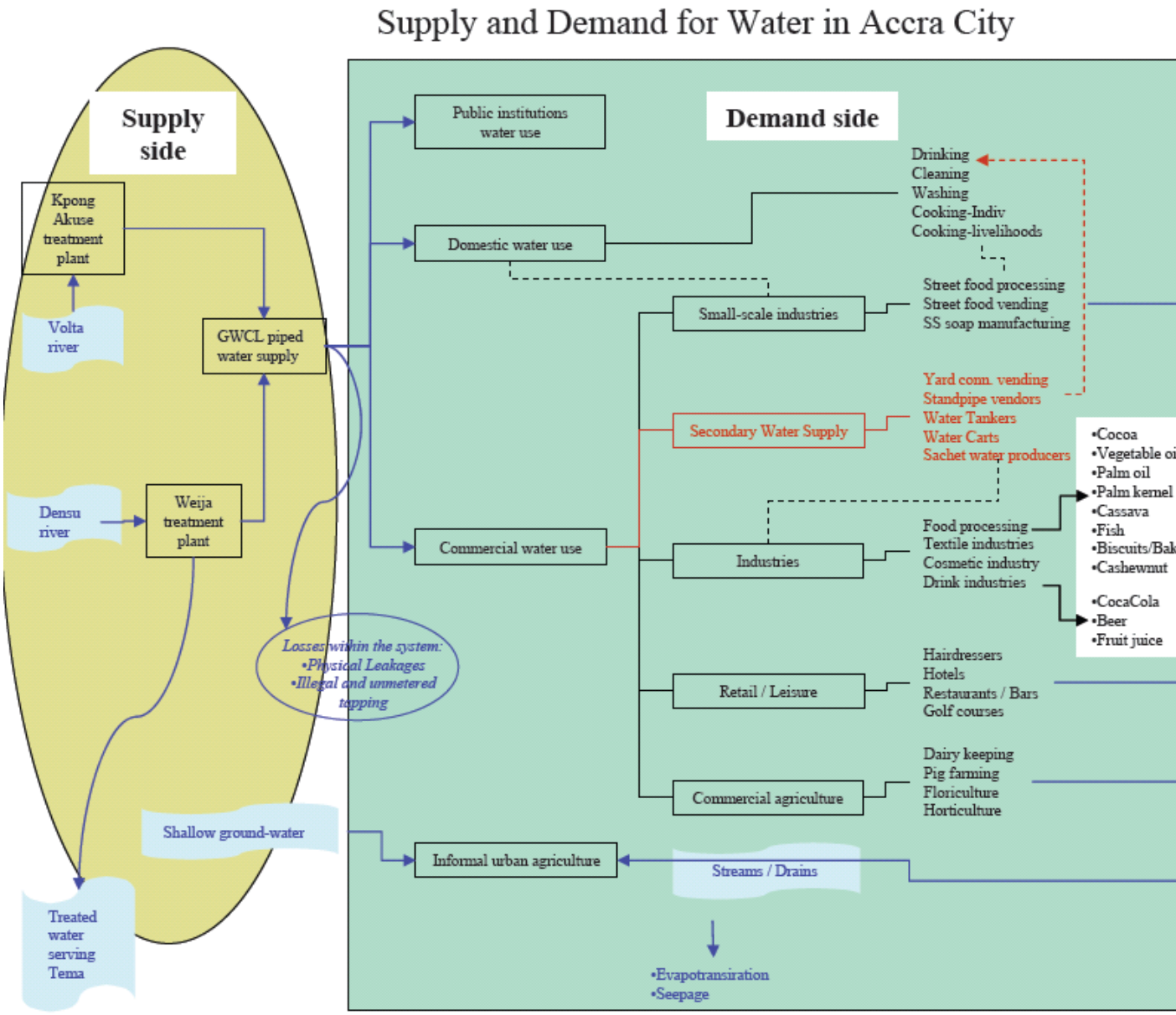

Figure 1: Supply and Demand for water in Accra city

In developing the framework for analysis it was first necessary to visualize the urban water use pathways to be able to identify the types of activities likely to utilize domestic water for livelihood purposes (Fig 1).

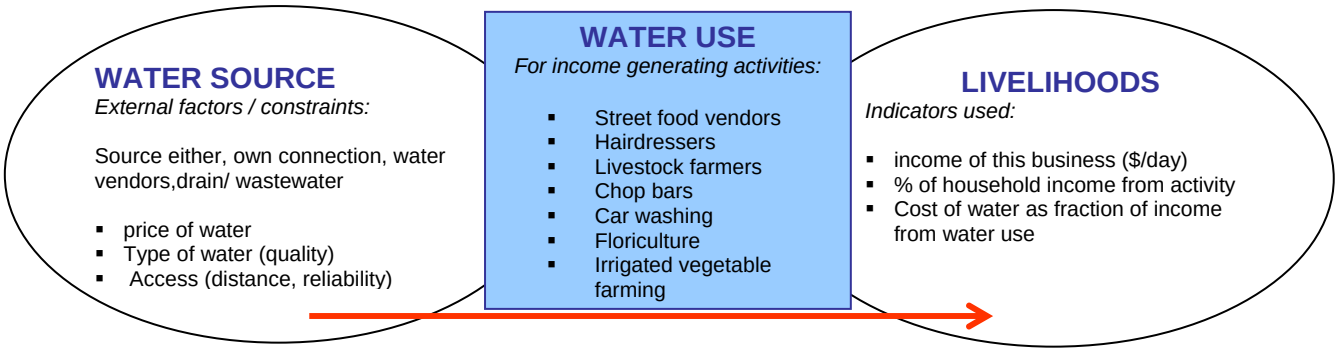

Fig. 2. Illustration of linkages between urban water and livelihoods through the various income generating activities.

Quantification of this water use through an identified set of indicators that show its economic significance, and identifying the constraints will be the first step towards improved decision support. A preliminary set of indicators are shown in the livelihoods box in figure 2. The profitability (income from the business) of the enterprise gives an indication of the overall economic demand for and sustainability of this enterprise. The part of household income that is generated by the water-use-activity gives an indication of the household dependency on this activity and consequent water requirement. The part of costs or household income that is spent on payment for the water gives an indication of the value of water and willingness to pay to sustain their activity.

The sources of water for these activities are essentially own piped connection (charged at domestic tariff rates by the Ghana Water Company Ltd), water vendors, and drain/wastewater. The external factors influencing or constraining water use are the price paid and therefore the amount used; the quality of the water (clean water is used for food preparation and cleaning related activities; and the distance to source and reliability of supply, which again influences how much water is collected and used.

Additionally information was collected on water use by households for domestic purposes (like cooking, bathing and drinking), in low income neighborhoods, where households mainly depend on water vendors to supply their needs. This also provided a rapid estimate of the willingness and ability of households to pay for domestic water use. This figure allowed us to surmise on the extent to which they would stretch if the water was also providing them with an income.

3 Methodology

Preliminary brainstorming and discussions with persons familiar with city developments patterns and income generating activities, and informed persons from the municipal and sub regional authorities, allowed us to develop figure 1 which shows the water supply and demand pathways for the city of Accra. This helped to isolate the different categories of informal sector, non-registered, income generating activities likely to utilize urban domestic water. All information was gathered through exploratory surveys which used rapid assessment interview methods supported by a checklist of questions. The objective was to quantify the indicators listed in figure 1, and identify the water related constraints that were faced by the users in the pursuit of their livelihoods.

As this was only exploratory, a very small sample of users was selected. The Accra Metropolitan Area comprises 6 sub-metropolitan districts, which are further divided into 13 constituencies. These constituencies are divided additionally to 68 electoral areas. Some of these informal income generating activities (like chop bars, food vendors, and hair salons) were known to be scattered randomly in all of the electoral areas. Six electoral areas were selected and a few persons were randomly picked for the interviews. On the other hand, some activities like urban and peri-urban farming (for irrigated vegetables, and livestock) were very location specific (2 electoral areas in all). Within these locations, a few persons were randomly selected and interviewed.

Data on per capita urban domestic water use was available from secondary literature which was dated, and more recent figures from Ghana Water Company Ltd which did not focus on the poor. So a rapid survey of a small sample of the poorer users from similar backgrounds to those involved in informal sector activities was conducted to update the existing information. Here too, open ended interview techniques were used.

Information presented on the urban irrigated vegetable farming is based on very comprehensive surveys and studies that were carried out previously (Obuobie et al 2006, Abraham et al., 2006a) In all ten different enterprise types categorized in five group were interviewed at nine locations in urban Accra (Table 1).

4 Results and Discussion

4.1 Enterprises using urban water and wastewater

Table 1 provides a brief description of the different enterprise categories highlighting the type of clientele, the gender representation and the quality of water used. As can be seen, many of these small scale informal livelihood activities are the mainstay of women, and difficulties and constraints faced in the provision of water will have impacts foremost on the earning capacity of women

For all the enterprises listed in Table 1, water is an indispensable and irreplaceable, ingredient. In the small scale food business as can be expected, a large portion of the water used is for washing the dishes and containers used for cooking. Potable water quality is essential. In the beauty business most of the water used is for washing of hair and the bacteriological quality is not so important. Hardness of the water is much more of a concern. In the livestock business, the water is used for feeding the animals so even though piped water supply is used the quality is not such an issue. Car washing, floriculture and irrigated vegetable farming do not need water of potable quality. The water users are aware of this to a large degree because they use non-potable water in many of the cases.

Table 1. Enterprise categories and locations and number interviewed.

Enterprise category	Description
Food vendors	

Tea and beverage	These vendors prepare tea and beverage with hot water and sell in the morning and in the evenings. The tea or beverage is sold together with bread and fried eggs. The water use includes preparation of tea and washing of cups. Customer base ranges from high to low income earners. Gender representation: Men and women Water quality : Clean piped water supply
Porridge	This kind of watery porridge is known as "Hawsa KoKo" in the local Ghanaian parlance and is consumed essentially in the mornings but sometimes also in the evenings. It is prepared from sorghum. A lot of water is used in its preparation. The water is used in the preparation of the porridge and the washing of utensils. The customer base ranges from the high income to low-income earners Gender representation: Women Water quality : Clean piped water supply
Fast food joint	These vendors have become very important in the lives of the city dwellers who have little time for food preparation. They are also a cheap source of food. They are seen in many suburbs of both high and low-income neighbourhoods. They sell mainly fried rice and 'wakye' also known as colored rice; and occasionally local food like yam, and fufu. A lot of water is used right from the preparation to the washing of the plates during sale of food. Gender representation: Men and women Water quality : Clean piped water supply
Chop bar	These mainly sell traditional/local foods such as fufu, banku, rice etc. accompanied by local soups and stews. Employees are mostly women. Chop bars serve as a major street food source for all categories of people. Gender representation: Women Water quality : Clean piped water supply
Restaurant	There are several classes of restaurants. The class determines the cost of food sold in it. Restaurants also sell all kinds of dishes ranging from traditional to continental. Water is an important resource in this business and used in the food preparation, washing of plates, glasses, cooking utensils and cleaning. The customer base range from medium to high-income groups. Gender representation: Men and women Water quality : Clean piped water supply
Hair and beauty salons	
Beauty salon	Such salons offer all sorts of beauty treatments like facials, manicures, pedicures and other skin treatments, for women mainly. They are very popular in all neighborhoods irrespective of income class. Some beauty clinics may also do hair dressing. Relatively less water is used as compared to hair dressing salons. Water is used for washing the face, feet, towels etc. Gender representation: Women Water quality : Clean piped water supply
Hair salon	Salons are places for women to wash and reattach their hair. This is a popular practice among African women. They are found in almost every locality. Water use is for washing the hair, towels, cleaning hair equipment etc. Gender representation: Women Water quality : Clean piped water supply

Livestock	These farmers are found at specific locations within the city. Those who keep animals usually live in low-income communities. The livestock keeping serves as a sort of relief during hardships when the animals are sold for an additional source of income. Water use is for the animals to drink mainly. Customer base varies, but mainly by butchers, individuals during local festivals. Gender representation: Men Water quality : Clean piped water supply
Car washing	Car washing enterprises use significant amounts of water. There are two types of car washing bays. Formal ones that are connected to GWCL water pipes and pay commercial rates. There are also informal car washing bays where water from drains is used or water is purchased from tanker operators. Customer base is varied from taxi drivers who have their cars cleaned and middle and high income car owner. Gender representation: Men Water quality : Clean piped water supply and Wastewater
Floriculture	Floriculture is a business venture that is also located along streets to ensure unhindered visibility. There are several selling points within the city. Floriculturists use different sources of water. The water could be pipe water, stream, or dugout. Significant amount of water is used in the nursery and plant stages. Customer base are the middle and high income groups who can afford to buy plants and flowers. Gender representation: Men and women Water quality : Clean piped water supply, Groundwater and Wastewater
Irrigated urban vegetable farming	Please see detailed section below Gender Representation: Men Water quality: Wastewater

4.2 Livelihood importance of urban water use and constraints

Table 2 gives water use data for the cases interviewed and the related livelihood information

Table 2: Water and Livelihood data for the cases interviewed

Enterprise + no. persons interviewed	Water data				Livelihood data		
	Source[quality]	Price of water cedi/liter	Constrained by [when]	Expenditure on water (cedis/day)	Income (cedi/day) [no customers per day]	Relative water costs (% of income)	HH income contribution (%)
Tea and beverage (2)	Public standpipe [good]	26.54-44.2	Absence water seller / [intermittently]	500-2,500	60,000 [20]	1-4	100
Porridge (1)	Neighbors tap [good]	18.5	Distance [daily]	5,000	450,000 [1500]	1	100

Fast food joint (3)	Private or neighbors tap [good]	4-5.5 (GWCL domestic rate)	No problem	na.	30,000 – 3 Million [20-300]]	na	-
Chop bar (4)	Private or neighbor tap/public institution [good]	23.5	Low water flows [intermittent]	na	100,000 – 6 million [20-1500]	na	100 (2) second income (2)
Restaurant (2)	Private tap (commercial or domestic connection) [poor when intermittent]	6.9 (GWCL commercial rate)	Low water flows [intermittent]	5000	Upto 1,200,000 [250]	0.6	100
Beauty salon (1)	Neighbor's tap [good]	na	[intermittent]	na	na [1-10]	-	100
Hairdressing salon (5)	Neighbor's private tap (2), own private (2), public institute [good]	17.7-23.5	In some cases access difficult/ unreliable/ [intermittent]	1,000 – 3,300	50,000 – 100,000 [5-10]	1 - 7	Depending on position in enterprise
Livestock (5)	Neighbor's tap [good]	29.4-58.8	Access difficult [daily]	4,000 – 10,000	15,000 – 200,000 [# livestock]	5-20	Only source (3)
Car washing (3)	Stream (wastewater), own private or commercial connection [poor for wastewater. Piped water good]	Free(stream/ Wastewater) na (piped water)	Unreliable [intermittent] (then turn to water tankers)	0 – 60,000	100,000 – 300,000 [10-30]	0-30	100
Floriculture (3)	Private commercial, stream/ dugout	Free (stream) na(	Unreliable [intermittent]	Free	16,666 -33,333 [25-30]	na	100

Note: na – not available

Table 3 : Per capita water use differentiated by means of water supply

Means of supply	% of households	Per cap water use (l/cap/day)
Own private connection or yard tap	60	98 (house connection) 65 (yard connection)
Neighbor's private connection or yard	25	34 (neighbours)
Commercial water seller	14	31 (other)
Standpipe	1	29
Borehole and well	0	31 (other)
Total / average	100	55

Source : London Economic (1999)

Table 4 : Per capita water use related to household size, cost of water and cost to household in old Fadama, a low income settlement

Sample	Household size			Cost/liter cedis*	Consumption liters/capita/day	Total water use liters/day
	Adults	Children	Total			

Case 1	6	4	10	15.69	59.4	9314.3
Case 2	1	4	5	11.76	30.8	1814.3
Case3	5	7	12	14.71	30.8	5428.6
Case 4	2	3	5	41.18	25.3	5200.0
Case5	5	3	8	23.53	28.8	5428.6
Case 6	5	5	10	23.53	30.8	7257.1
Case 7	2	2	4	11.76	35.8	1685.7
Case 8	2	3	5	41.18	49.5	10200.0

* 1USD is approx 9000 cedis Source: study data from a sample of 8 interviews

In Accra city the poor source water from a large and thriving informal sector water trade conducted by informal vendors who ply their trade in the local neighbourhoods to which they belong. These vendors serve a very useful purpose providing water in small quantities to the poor who can afford neither large storage nor large sums of money for one off purchases of water. Results in Tables 2, show that to earn their livelihoods, people are willing to go to great lengths to access water, often paying between 18 an 59 cedi / liter of water which is 3.6 to 12 times higher than the water utility domestic rate (4-5.5 cedi/liter), and 2.6 to 9 times higher even than the water utility direct commercial rate (6.9 cedi/liter) for water. Many of the informal enterprises visited used substantial amounts of water in relation to the activity with expenditure on the water being upto 30% of the income generated by such water use. The high percentage is due to the very high prices in certain neighbourhoods which receive intermittent water services. The informal enterprise may even be a neighbour who has a household or yard connection and is willing to share the water s(he) pays for, at a price. Tables 3 and 4 show the data from a very small sample of households who buy the water for domestic use only. Here too users pay upto 8 times the domestic rate which figure is in excess of even the commercial rate. These prices are a function of the availability of water at the specific location. The water utility is aware of this aberration, but as they ‘improve the coverage of potable water’ in the city without the intervention of the water utility, it is in their interest to encourage the service.

The quality of water from these vendors, is perceived as good in the majority of the cases, since the origin of the water is the treated city water supply. On the other hand, wastewater when used for cultivation (see section 4.3 for more details), is perceived as being of acceptable quality for the use. Farmers do not necessarily avoid contact with the water either

In terms of livelihoods significance, for many the income from these informal enterprises, represents 100 % of their earnings. They exist because there is a demand for such services, and in addition they provide employment and support a chain of beneficiaries.

4.3 Irrigated urban agriculture systems: - significance and livelihood potential.

It is estimated that about 100000 m^3 per day of wastewater is generated, though this is based on an average per capita daily consumption of 76 liters (MoWRWH, 1998), and a wastewater return flow of 80%. A portion of this reaches the stream and drainage network of the city which serves as the main source of water for irrigated urban agriculture. In Accra about 680ha are under maize, 47 ha under vegetables and 251 ha under mixed cereal-vegetable systems. In addition about 50-70 ha are distributed over 60% of Accra's households (80,000 tiny backyards). Plot sizes under cultivation in the city range from 0.01-0.02 ha per farmer, and increase up to 2.0 ha in peri-urban areas. In Accra practically any open space is used for farming vegetables and other crops because of the high demand from the city Land is continuously lost to estate developers hence the shrinking size of farmlands. (Obuobie et al., 2006).

Depending on the source of water, collection and application can vary. In the case of streams, the water is fetched and applied to crops with buckets or watering cans. Some farmers dig shallow wells close to the streams where the water table is high, or channel the drain water into shallow ponds and fetch it with watering cans. Where piped water is used it is applied with a hose or collected in shallow ponds and fetched with watering cans or buckets.

In total there are about 100ha under vegetable irrigation in the dry season.As the rainfall in Accra is low (730 mm/year), vegetable farming which has high water requirements, is mainly dependent on irrigation. It is therefore mainly practiced on valley bottoms along streams, which are now practically wastewater conduits. Farmers do not pay for this water and they perceive the nutrients in the wastewater and its year round availability as advantages.

In addition AMA has provided standpipes for farmers at some sites to serve as alternative sources of safe water (e.g. Dzorwulu, North Dzorwulu and La). The volume and availability of water depends on the supply and distribution of potable water by the Ghana Water Company Limited (GWCL). Farmers could either pay a flat rate irrespective of the volume of water used or pay by volume of water used. Farmers using piped water are in groups and share the bill according to the number of beds each farmer crops.

There are about 800-1000 vegetable farmers in Accra .Open space crop cultivation brings in very good earnings in spite of the challenge of crop loss. A study (Obosu-Mensah,1999) in Accra revealed that out of 200 urban farmers interviewed 60% had no intention of stopping farming even if they were offered a regular salaried employment. Furthermore, out of 138 farmers interviewed, about 60% totally rely on irrigated vegetable production as their only source of income while 33% do it as supplementary source of income. Monthly net income from irrigated mixed vegetable farming in Accra (US$ per actual farm size) is estimated at 40-57.

The practice is predominantly male dominated. On the average only less than 10% of all open space farmers were women. However, women dominate vegetable marketing.

In Accra, the contribution of urban agriculture and therefore wastewater, in terms of certain types of vegetables in the urban diet, may be substantial and therefore beneficial. Data show that 35% of lettuce sold in Accra originated from wastewater irrigation. No data is available on the contribution of other vegetables. Whilst positive health benefits are expected from consuming vegetables, this also has significance in terms of exposure of urban dwellers to pathogens conveyed through consuming raw

vegetables like lettuce. A survey in Accra has shown that daily, around 280000 persons consume food from street-food vendors, canteens and other public eating houses, containing 12 g of lettuce (Obuobie et al, 2006) with corresponding positive and negative health impacts.

The situation described above is specific to cities and the implications for urban authorities are complex. On the one hand urban agriculture serves a very useful purpose providing livelihoods to farmers and sourcing food to the city. On the other the urban water source used for irrigation is suspect. Ironically it is the city itself which has endangered its own food source, by the pollution it creates. The solution to the problem is not straightforward as a variety of stakeholders, are involved in this food production and consumption chain, that need to be consulted. Multi-stakeholder platforms that use innovative mechanisms for exchange of ideas are a necessity. Learning alliances are a potential tool for this purpose.

5 Conclusions and Recommendations

'Hidden' contribution of urban water and wastewater to livelihoods
According to the results of the preliminary survey, this 'hidden' commercial water use appears to be significant if valued in terms of numbers of direct and indirect beneficiaries, the contribution to their household income and the services they provide to the city population. This is particularly evident with irrigated vegetable farming.

Optimizing wastewater use in the urban water catchment
From an urban water management perspective in a catchment or watershed under water short conditions (as is the case with Accra), using wastewater for irrigation or for washing vehicles, is an innovative means of recycling a waste product. In cities where providing safe access to water supply for all is difficult, wastewater recycling for certain types of water use within the city that do not require potable quality eg car washing, floriculture/ horticultural activities, livestock watering, irrigated urban vegetable farming should be encouraged. However optimizing such use and rendering it safe would require that sanitary wastewater (also known as black-water from toilets/latrine facilities), and toxic industrial wastewater, is separated from grey-water (kitchen, washing, bathing wastewater) when it is directed to the open drainage networks in the city. This will reduce both the pathogen contamination and the toxic contaminants in the wastewater. This should be accompanied by researching and disseminating, small scale simple treatment methods for use under such conditions.

Institutional adjustment
Such solutions may require institutional adjustments. For instance in the case illustrated above, national and city level institutions that deal with water quality regulation, industry regulation, urban planning, sanitation, health and hygiene, and private sector design and construction engineers would all need to work together to make the recommendation practicable.

Creating the right learning environment
Above all the degree of comprehension and coordination necessary between institutions and individuals requires a paradigm shift. Such a shift can occur only when the right learning climate is established. Multi-stakeholder learning platforms with horizontal and vertical learning structures will raise issues hitherto unidentified and suggest innovative solutions. Comprehensive decision support tools can only be developed when the different needs of each stakeholder groups are correctly identified in unison and not in isolation. The Accra Learning Alliance is one such platform being established through the SWITCH project

Eliminating 'water barriers' and supporting women

The popularity of informal enterprises within the city is an indication of the service they provide, simultaneously providing employment to others as well, as the enterprise grows. Removing water barriers will assist them in their growth. Enhancing the access of poor communities to water will benefit their water dependent livelihood activities. Given the importance of such activity, this could be an effective way of decreasing poverty in such communities. The water utility together with the Accra Metropolitan Authority should encourage dialogue with users to identify constraints and discuss solutions. Many small enterprises are either owned by or employ women and this makes it imperative to mainstream them in the discussions pertaining to water needs, provision and demand management.

Is price regulation possible?

The preliminary studies show that the price of water paid by the poor seems inordinately high, compared to the water utility prices both for domestic and commercial connections. This affects their immediate household water use, but also limits their economic gains. From the perspective of the water utility also, the lost revenue from this consumption, may be considerable. In fact data shows that even if the poor paid commercial rates they would still be better off, and the amounts they pay currently are an indication of their willingness and ability to pay. Improving the water infrastructure would create a win-win situation for the water user, and the water utility, both of whom will have increased income/revenue from the water.

Acknowledgement

The authors wish to thank the following for the diverse roles they played in data collection: Elfrida Allotey; Yaa Owusu Bennoah; Daniel Spalthoff; and Samuel Oteng Boateng

References

Abraham, E.M., van Rooijen D., Cofie, O.O. Liqa Raschid-Sally, L 2006. Review on urban water resources and water demand for urban agriculture and other livelihoods opportunities in Accra. SWITCH Review Report. IWMI. 48p. Unpublished.

Akufo, S.B. (1998) (2nd ed.). *Pollution Control in a Developing Economy*: *A study of the situation in Ghana*. Ghana Universities Press. Accra, Ghana.128p.

EPA. 2001. Status of Sewage Treatment Plants :Internal monitoring report. EPA: Accra

GWCL (2006) Ghana Water Company Limited, unpublished data received in October 2006.

London Economics (1999). Ghana Urban Water Sector, Willingness and ability to pay, Demand assessment and Tariff structure s
tudy. In association with John Young & Associates **.**

MoWRWH (Ministry of Water Resources Works and Housing). 1998. Ghana's Water Resources. Management Challenges and Opportunities. Accra. 78p

Obuobie, E., Keraita, B., Danso, G., Amoah, P., Cofie,O.O. Raschid-Sally, L. and P. Drechsel. 2006. Irrigated urban production in Ghana: Characteristics, benefits and risks. IWMI-RUAF-CPWF, Accra, Ghana: IWMI, 150pp.

Obosu-Mensah, K., 1999. Food production in urban areas. A study of urban agriculture in Accra, Ghana. Ashgate Publishing, Aldershot, UK, 227 pp.