34th WEDC International Conference, Addis Ababa, Ethiopia, 2009

WATER, SANITATION AND HYGIENE:
SUSTAINABLE DEVELOPMENT AND MULTISECTORAL APPROACHES

Incorporating productive use into water systems in urban Nigeria

Joachim Ibeziako Ezeji, Nigeria & Ian Smout, UK

REFEREED PAPER 224

Recent studies have shown that millions of low-income households use their limited water supplies for activities such as productive uses as well as domestic needs. Such productive uses of water may not really thrive or even take off unless the required quantity of water is available. Such activities often generate numerous benefits to households involved. An understanding of how productive uses of water could successfully be mainstreamed into urban water systems in Nigeria was studied. Water supplies to households by the water utilities in Nigeria have traditionally been confined within what is known as domestic water needs. The quantity of water supplied has often been meant to cover basic needs such as drinking, cooking and personal sanitation needs etc. However this has not been a true reflection of the use of this limited amount of water supplied. A social survey was made of households and institutions in Owerri, Nigeria; where productive uses of water is already real, particularly in activities such as home gardening, horticulture and livestock rearing etc. In view of the persisting problem in water supplies in Nigeria, where water utilities such as the Imo State Water Corporation (ISWC) is still enmeshed in intermittent supplies; the paper explores the implications for households, especially the productive water users; alternative water suppliers and the government. The aim is to identify how supply sustainability for these activities could be maximized as a veritable tool vital in the fight against poverty. Given the importance of the urban water system to low income productive water users, a functional and efficient utility as well as an appropriate policy framework has been identified as being imperative in order to maximize income and employment benefits for urban productive water users.

Introduction

As the world becomes more urbanized and poverty becomes an increasingly urban phenomenon, it also, becomes pertinent to understand the role of water as a key contributing factor to the incidence of poverty or otherwise in urban centers. The link between poverty and water in urban centers often seems misunderstood. The reality is indeed startling as the global urban population without access to improved water services rises from 107 million in 1990, to 170 million in 2004 Owen (2006; 7). Many of the inhabitants of these big cities have no or inadequate access to running water. This is particularly true for cities in Africa where government and government utilities have limited means to maintain coverage and quality of existing water supply services, while they also need to expand and improve services to meet the ever increasing needs of industry and to support growing population with varying distribution of economic activities and settlement patterns. The result is that dwindling household incomes have necessitated the rise in various informal small-scale entrepreneurial activities in urban centers around the world, especially the third world. The effect of all these on urban water supply can no longer be ignored or glossed over. The biggest challenge therefore, is evolving a new way of managing the city to enable it tap the potential inherent in the size and innovation that drive the urban population. The reality of this is particularly more evident in water use.

Understanding the term 'Productive Use of Water'

Moriarty *et al* (2004:21); describes 'Productive Use of Water' as the water used for small scale, often informal activities whose primary purpose is improved nutrition or income generation. It was therefore defined as a quantity of water over and above domestic 'basic needs' that is used for small scale productive uses. Bustanmante *et al* (2004:144); defined domestic water as commonly understood to include the water needs of families for drinking, cooking, washing and sanitation/hygiene. This definition covertly offers accommodation to sundry economic activities such as vegetable gardening, fruit trees, beer brewing, tea shops, road side eating shops, hair dressing, livestock rearing, ice block making, grass-mat weaving, smearing and plastering of walls and floors, medication and religious rituals, baking, poultry, pig rearing, fish pond, recreation (e.g. Watering of lawns and swimming pools) etc. No doubt these coteries of activities are productive because they engage (time, effort and money) the individuals involved in them and at times serve as an income generating activity for them. An appreciation of the huge potential benefits realizable from these activities often leads to demands that they be specifically catered for particularly in the design of urban water systems as one important tool to check urban poverty.

Defining the borders of domestic water

According to Moriarty *et al* (2004;27) systems that are designed to provide minimal domestic 'basic water' supplies and that do not take account of productive uses can be expected to fail if people actually want to use its water for productive activities (often through illegal connections). The opportunities of productive uses and threats of inequity and conflict were explored by Butterworth and Smout (2005).

Further to the foregoing,UNECA (1999; 29) states that the provision of water supply in human settlements involves tapping the most suitable source of water, ensuring that the water is fit for domestic consumption and supplying it in adequate quantities, but it is clear following Moriarty *et al* (2004) that ''adequate quantity'' may be interpreted in various ways, for a range of water uses. Considering domestic use, the UNICEF/WHO Joint Monitoring Programme defines an improved drinking water source as being more likely to provide safe drinking water than a not- improved drinking water source, by nature of its construction, which protects the water source from external contamination particularly with fecal matter WWDR2(2006; 225). This definition however did not consider quantity and access hence necessitating the need for a broader definition. It was, however realized that it was not just water quality but also water quantity which mattered in achieving health improvements, and that quantity in turn was dependent on accessibility as documented by Robinson *et al* (2004, 174). It was based on this particular premise that Howard and Bartram (2003) proposed four access categories. This was based on the relationship between accessibility (expressed in time or distance) and the likely quantities of water collected and used. From Table 1, the four categories are: no access, basic access, intermediate access and optimal access.

Howard and Bartram (2003) argued that an improved water supply source should provide adequate quantities for bathing and clothes washing as well, but recognize that the quantity per person required corresponds only to the level of basic access. It should be recalled that basic access is the current global standard for access. Considering the multiple uses of water services, Moriarty *et al* (2004; 23) therefore suggests that it is essential that development of water resources and services be based on a clear understanding of the full range of uses to which people put (or might put) the water provided. This in a nutshell demands the need to listen to people and putting their needs first. Moriarty *et al* (2004; 40), insists that water used for small-scale productive purposes, with its potential to make limited but measurable improvements in the lives of billions of people should be added to this 'domestic' supply when making rights-based allocations of water resources. They proposed the term 'household' water to encompass this combination of domestic and small-scale productive supplies. Hence Smit *et al* (2008) proposed the multiple use water ladder shown in Table 2.

Table 1. Requirements for domestic water service levels and health implications			
Service level	**Access measure (distanced or time)**	**Needs met**	**Level of health concern**
No access: quantity collected often below 5litres (L) per capita per day.	More than 1,000 metres (m) or 30 minutes total collection time.	Consumption cannot be assured. Hygiene not possible (unless practiced at the source)	Very high
Basic access: average quantity unlikely to exceed 20L per capita per day.	Between 100 and 1,000m or 5 to 30minutes total collection time.	Consumption should be assured. Hand-washing and basic food hygiene possible; laundry and bathing difficult to assure unless carried out at source.	High
Intermediate access: average quantity about 50L per capita per day	Water delivered through one tap on plot or within 100m or 5 minutes total collection time.	Consumption assured. All basic personal and food hygiene assured; laundry and bathing should also be assured.	Low
Optimal access: average quantity 100L per capita per day.	Water supplied through multiple taps continuously.	Consumption assured. All needs met. Hygiene need all met.	Very low.

Source: Howard and Bartram (2003).

Table 2. Water service level requirements for multiple uses at household level			
Service level	**Distance or round trip**	**Quantity (lpcd)**	**Potential needs met**
Maximum multiple-use service	Water at the homestead	>100	All domestic needs Not all but in some combination; Livestock Extensive gardening Small-scale enterprises
Intermediate level multiple-use service	Water at the homestead, or within 5min round trip	50-100	Basic domestic needs Not all but in some combination; Couple of large livestock Gardening up to $50m^2$ Some micro-scale enterprises
Basic multiple-use service	Round trip less than 15 min at distance between 150-500m	20-50	Basic domestic needs Not all but in some combination; Some livestock Some gardening, especially with re-use Some micro-scale enterprises
Basic domestic service	Round trip up to 30 mins, or distance less than 1km	10-20	Sufficient for drinking and cooking Hardly sufficient for basic hygiene Insufficient for other domestic uses Possibility for re-use for occasional trees and very limited livestock (e.g. few chickens or a goat)
No domestic	Round trip more than 30 min, or more than 1km	<10	Sufficient for drinking and cooking Insufficient for basic hygiene

Source: Smits *et al* (2008).

Methodology

A social survey of households and institutions in Owerri city was carried out to obtain the people's views, and observe their daily economic activities as it relates to the way and manner they use their drinking water supplies for economic and productive enterprises. Particular attention was focused on the water supplied by the Imo State Water Corporation and the alternative water suppliers. Research tools used in doing this study included Questionnaires, Focus group discussions and Observations. Further information was obtained from local newspapers, personal discussions and review of institutional documents. A total of 61 questionnaires were prepared and distributed; however a total of 41 of these questionnaires were returned by respondents representing a total of 67.2% of the total. A break down into the two groups showed a representation of 56.66% for institutions and 77.41% for households. Quota sampling technique was used in selecting respondents. In using quota sampling, the study applied quota controls. Physical or observable features make the best quota controls (Nichols, 1991;68). For example, since the study was a small exploratory study, the research specified a small quota of productive water users in the towns being studied based on sex, type of water use activity as well as neighborhood or housing area etc. The quota was located in the field through physical observation, and then interview or conversation with those found and identified. The use of quota sampling has been adopted because the target population is to be taken from any location convenient to the study and wherever a household or individual with the relevant characteristic was seen. This process continued until the required target number of respondents was met. Other factors favoring the adoption of this sampling technique was its affordability as well as its time saving nature since it neither required a sampling frame nor a foreknowledge of the total number of the sample population. It easily guaranteed the unhindered inclusion of the type of people needed (Kumar 1996; 61).A total of six focus group discussions were conducted.

Case study findings

Owerri is the capital city of Imo State, Nigeria. The geographical area of Imo State is located in the South Eastern zone of Nigeria. Owerri is predominantly an urban community with a population of about 1.5million people. The annual growth rate of the population is put at 4.5% (NPC, 2007). This is equivalent to a population density of over 400 persons per square kilometer. The Imo State Water Corporation (ISWC) has the mandate to supply water to the urban and semi-urban areas of Imo State especially Owerri. Table 3 below shows the percentage consumption by the major consumers.

Table 3. Percentage estimate of users of ISWC supplied water

Category of water user	% of consumption
Domestic	35
Commercial	20
Industrial	45

Source: Okereke *et al* (2000).

Presently ISWC has an effective coverage of 31% of the city's population of 1.5million and usually supplies are intermittent. Most people in Owerri city are generally poorly served and hence complement their limited ISWC supplies from surface sources (e.g. car washers and brick/block molders etc); commercial boreholes (Horticulture; household gardens and Ice block makers); and water vendors (e.g. Restaurants etc). Due to the intermittent nature of the ISWC supplies and the high cost of water from these alternative sources the average consumption per household of six people in Owerri has shrunk since 1997 to between 80-100L per day. The volume of Unaccounted For Water (Non Revenue Water) is estimated at 50-69% of current supplies (Okereke *et al* 2000;174). Water supplies to consumers or ISWC customers are based on fixed tariff that is payable on household bases as no single meter is in use anywhere in the city. The implication is that household productive water users such as those making Ice blocks, Home gardens, commercial car washers; Horticulture; Bricks/Block makers and Restaurants etc have the potential of using more water than is accounted for. Associated with this is the realization that some of these potentials are either "covert" or "overt" in most cases. The efficiency of bill collection by ISWC that is based on fixed tariff that is payable without metering has been estimated by Okereke *et al* (2000; 171) to be less than 30%.The result is that ISWC loses one of the most important benefits of water metering which is the revenue it provides for water operations. The Imo State Water Corporation in Owerri is well aware that some residents are currently using the limited water supplies for sundry activities like home gardening, commercial flower gardening, watering of lawns and commercial washing of cars as well as for brick/block making. The harvesting and use of rain water in these activities is not really optimized. Amongst the 6 productive water user groups identified in the study, the Willingness to Pay (WTP) for ISWC water was higher among the Restaurant and Ice Block groups. This was assessed based on their overwhelming subscription to the introduction of meters. Currently these two groups use 250 and 50-100 l/p/d of water respectively which they source 50 and 75% respectively from water cart vendors. They operate basically within their households. Both activities are dominated by women and represent the highest number of productive users surveyed. Their activities are more water efficient than the other groups. The Horticulture, Car Wash, Bricks/Block Making and Home Garden groups have already been under scrutiny by ISWC because of the poor reputation of using and wasting so much water. Despite the fact that they currently use higher quantities of water per day, they are often hesitant to pay anything near commensurate charges. They are notorious for many cases of illegal connection and disruption of water flows. They strongly oppose the introduction of meters because of the latent fear that it will not only expose their high level of water wastage but impose higher bills on them. They are rather contented with the existing status quo which tends to favor them because they currently underpay.

Table 4. Estimate of average income from productive uses of water in Owerri city

User/activity	Average daily quantity of water used (litres)	Monthly tariff payable to water utility.(Naira)	Average monthly cost of water if purchased from the vendor (Naira)	Average monthly land/plot/space rent (Naira)	Average monthly income (Naira)
Horticulture	250-450	5000	12000	3000	45000
Car Wash	500-1000	7000	20000	2500	55000
Brick/Block	1000-3000	15000	40000	10000	90000
Ice Block	50-100	1000	2500	5000	7000
Home garden	250-450	2500	3000	10000	15000
Restaurant	250	1500	3200	4000	20000

Source: Author (2007). Note: All stated figures concerning payments and income are rough estimates because they are very variable as they are based on variable factors such as rate of patronage and use of service. Only the tariff from ISWC and land/property rent is constant. (1US$ equals 115Naira.)

Discussion

Considering the regular, though small income (as shown in Table 4 above) being generated from productive water uses in Owerri, it would be proper to provide for their water needs in urban water budgets. This has become imperative in order to effectively manage the accompanying threats to system sustainability and mitigate poverty. Moreover, prioritizing the water needs of productive users should be blended with traditional domestic supplies to dynamically achieve optimal sustainable development. This is true for Owerri where for example, many home-based informal enterprises like restaurants and bricks/block making activities are earning income from their distribution links with formal enterprises in the global chain of production. However this remains problematic as a lot of factors come into play. Metering of utility supplied water is one such factor. It should be noted that water meters are necessary for implementing full-cost pricing. Full cost pricing is based on the economic principle that utilities should charge water rates that reflect the total costs of replacing and upgrading infrastructure.

However, it has been noted that water metering can be detrimental if water prices are set too high by utilities. An unaffordable rate structure can threaten the health and welfare of economically disadvantaged populations such as the urban poor and those of them involved in productive water uses particularly if they cannot afford to pay for a necessary amount of water. The rising block tariff has been suggested by (Sansom, undated) as one way to try to avoid such a problem. He suggests that this could be done by calculating an average monthly consumption rate needed to cover key human needs and then charging a basic rate for this amount and a higher price for any consumption above that amount. The implication of this to productive water use in urban areas such Owerri is yet to be explored. The failure to meter water supplies in Owerri has caused more confusion than order. This is so because the arrangement involving metering and billing per household links human behavior to economic resources and the assumption is that an increase in water price reduces use (Lallana *et al.*2001) as quoted by Helena Krantz (2005). This creates an incentive to reduce the low-value use; its use is not considered being worth the money. For the ISWC to restore a lead to consumers on water efficiency, it must amongst other factors get on top of its leakage problems. Other enabling indicators for a viable utility are according to Sansom *et al* (undated; 7) the Working Ratio; and the Staff per 1000 Connections. These indicators often serve as yardsticks for measuring utility performance and the possibilities of a formal productive use in urban water systems. A working ratio (i.e. operation and maintenance expenditure divided by the total revenue) should be around a value of 0.5 for a utility to generate sufficient revenue to fund effective service provision including future investment. Therefore more water supplies will exert operation and maintenance (O&M) on the utility. A rise in O&M that is higher than the revenue may not support productive use. A ratio of a utility staff per 1000 connections is an indication of productivity and efficiency. It also marks good service performance level. From the study most viable option for productive water users in Owerri is to secure access to water through a range of alternative approaches such as rain water harvesting and household level waste-water reuse etc. However, militating against this is housing insecurity.

According to Moser (1996, 23), housing insecurity, such as when households lack formal legal title, increases the vulnerability of the poor. In Owerri, most of these productive water users live or operate on rented plots; this together with huge capital costs hinders the option of any sustainable rainfall harvesting. This is in the face of the reality that the city records an average of 2000mm of rainfall per annum. Earlier findings show that rainwater costs about five times as much as metered water supplies in Sri Lanka, and that it takes 20-25 years to recover the capital cost of such investment in Namibia (Skinner, undated). The apparent inertia and apathy in utilizing rainwater as an option in Owerri by these groups could therefore be appreciated from this standpoint. But when the poor have some secure ownership of their housing, they often use this asset with particular resourcefulness when other sources of income are reduced. Home owners use their homesteads as a base for productive activities e.g. vegetable gardening; horticulture and livestock etc (which may not be permissible if the occupier is on rent).Therefore the importance of land and housing in combination to water as productive assets in the urban context has become evident especially in poverty alleviation.

The Owerri situation reflects the situation in most other Nigerian cities such as Lagos and Jos etc. The Lagos State Water Corporation (LSWC) as reported by the Guardian (2009) accused car wash operators, water vendors, horticulturists and sundry groups etc of tapping its water through illegal connection and acts of vandalism and wastage of water. In Jos, the problems of water wastage and illegal connection by car washers and horticulturists being experienced by the Plateau State Water Board (PSWB) has been reported by Ezeji (2005). However, Owerri, unlike Yaoundé city, Cameroon is yet to come to terms with the reality of waste water reuse.

A study by Raschid-Sally *et al* (2004; 95-116) in Yaoundé had investigated 3 urban and peri-urban sites where the use of waste water in productive activities in agriculture was already a norm. Vegetables, especially the indigenous leafy variety as well as salad, leeks and lady's finger etc and horticulture were commonly irrigated with waste water. In Yaoundé 96% of farmers were producing vegetables and flowers for commercial purposes while only 4% produced for exclusive family consumption. Household waste water reflects what the residents consume, and therefore changes over time. In the current consumer society and chemical society it contains a wide range of substances, and wastewater today may contain as many as 30000 different chemical substances (Palmquist, 2001) as quoted by Helena Krantz (2005). Household wastewater is a mix of nutrients (e.g. phosphorus, nitrogen and potassium), other chemicals (e.g. metals and anthropogenic organic substances), various solids and pathogens (e.g. bacteria and viruses). The nutrients originate mainly from food, and some of the phosphorus from detergents. Metals originate from several sources such as food, tobacco and snuff (cadmium), amalgam tooth fillings (mercury), wear and tear of objects (cutlery, zippers, casseroles etc) and pipes, etc.(Naturvardsverket 1995) as quoted by Helena Krantz (2005). In addition, residents dispose of a wide range of products and substances in toilets and drains.

In Owerri houses, these are normally mixed and piped together into drains or septic tanks connected to soak-away pits. The total volume of water used in households is about $59m^3$ per household of 5 persons and year. If all these waste water is re-circulated to agriculture, between 75% and 85% of the nitrogen, phosphorus and potassium from the households will be used as a resource instead of being a potential pollutant to the environment.

Conclusion

Given the importance of the urban water system to low income productive water users, a functional and efficient utility and an appropriate policy framework is imperative in order to maximize income and employment benefits for urban productive water users. Water Utilities, Urban planners and Municipal officials should acknowledge that productive water uses are here to stay, and that they contribute to the city economy in many ways. It is germane to underscore that reducing urban poverty is not possible without supporting these productive water users. The government should promote inclusive urban planning, that includes participatory planning processes which addresses the key constraints and needs of different categories of productive water users. However, the major difficulty constraining the ISWC is its inability to provide investment for maintaining the condition and performance of their water assets. It needs to focus more on assets management and putting funds aside for depreciation, if it wants to achieve reliable services. To overcome these constraints, ISWC will need to design strategies to improve current service levels for all consumer groups and provide for the rapid increase in the urban population. Achieving these would possibly enable productive use, and this means the provision of quantity of water that is over and above those required for mere domestic needs. Legislative framework by the governments should concentrate on ensuring productive water users are well served through the timely provision of relevant infrastructure and support services to support like 24 hour water supply. It is germane to note that some productive water uses are more water efficient than the others. The study has amongst other issues in this context revealed that the desired Willingness to Pay (WTP) for water services is higher among the Restaurant and Ice Block groups. Their overwhelming subscription to the introduction of meters indicates so, together with the possible realization that ISWC supplies could be cheaper than those from alternative sources. An average small restaurant uses 250 l/p/d of water while an average ice block maker uses 50-100 l/p/d of water. Unlike other productive uses, very limited or insignificant amount of water is wasted on these activities. Waters used here were discovered to be sourced 50 and 75% respectively from alternative sources. In other words utility supplies make up less than 40% of these supplies. Another feature common to these two groups are that they operate basically within their households levels and are practiced dominantly by women (housewives); they also represented the highest number of productive users surveyed. In contrast, activities like Horticulture, Car Wash, Bricks/Block Making and Home Garden group have the poor reputation of wasting so much water. Despite the fact that they currently use much higher quantities of water than the average urban consumer, they are often hesitant to pay commensurate charges. They are notorious for many cases of illegal connection and disruption of water flows. They strongly opposed the introduction of meters because of the fear that it will expose their high rate of water wastage and its appropriate charges. To sustain the positive gains of these activities there is need to ensure and enhance sustainable urban water service delivery and waste water treatment and reuse in Owerri, Nigeria; there is an urgent need to address the overall challenges which include: the creation of stable economic environment and institution of good governance at all levels of governance; improving, planning, allocation and regulation; achieving economic and financial sustainability of utility investments/assets; building the capacity of stakeholders e.g. productive water users and therefore improving their socio-economic life as well as those of many others.

Acknowledgements

The authors would like to extend thanks to Rural Africa Water Development Project (RAWDP), Owerri Nigeria for providing the logistics for the study in Nigeria and Dr. John Butterworth for helping review the initial draft in 2006.

References

Bustamante, Rocio; Butterworth, John; Flierman, Mariska; Herbas, Daniel; Hollander, Marieke den; Meer, Sjoerd Van der; Ravenstijn, Paul; Reynaga, Magalyn; Zurita, German.(2004)"Livelihoods in conflict: dispute over water for household-level productive uses in Tarata, Bolivia", in Patrick Moriarty, John Butterworth and Barbara van Koppen (eds.) (2004) Beyond Domestic. IRC International Water and Sanitation Publications, Delft Netherlands, pp. 137-151.

Butterworth, J. and Smout, I. (2005) Productive uses of domestic water: opportunity or threat? Proceedings of the 31st WEDC International Conference, 2005.WEDC: Loughborough University, UK pp. 19-32.

Ezeji, Joachim I (2005) Gender Mainstreaming Report, Jos Nigeria. Unpublished urban water and sanitation assessment for gender mainstreaming report.RAWDP,Nigeria.

Guardian (2009) LSWC operation tackles illegal water vendors, wastage, vandals. Guardian Newspaper, Nigeria. Source: http://www.ngrguardiannews.com/homes_property/article11//indexn3_html?pdate=190109&ptitle=LSWC%20operation%20tackles%20illegal%20water%20vendors,%20wastage,%20vandals&cpdate=190109 Date Accessed: January 19, 2009.

Howard, G and Bartram, J.(2003) Domestic water quality, service level and health. WHO/SDE/WSH/03.02.Geneva,WHO.

Krantz, Helena (2005) Matter that Matters, a study of household routines in a process of changing water and sanitation arrangements. Linkoping studies in Arts and Science. Department of Water and Environmental Studies; Linkoping University, Sweden.

Kumar, Rangit (1996); Research Methodology; a step-by-step guide for beginners; Longman, Australia.

Moriarty, Patrick; Butterworth, John; Koppen, Barbara van.(eds.) (2004) Beyond Domestic. IRC International Water and Sanitation Publications: Delft, Netherlands.

Moriarty, Patrick; Butterworth, John; Koppen, Barbara van.(2004) “Water, Poverty and Productive uses of water at the household level”, in Moriarty, Patrick; Butterworth, John; Koppen, Barbara van (2004) Beyond Domestic. IRC International Water and Sanitation Publications: Delft, Netherlands.pp.19-44.

Moser, Caroline O.N (1996) Confronting crisis: a comparative study of household responses to poverty and vulnerability in four urban communities. World Bank, Washington D.C.

Neto, Frederico, Ha Yeyin; Weliwita, Ananda; (2007) The Urban informal economy- new approaches in UN-HABITAT Habitat Debate Vol.13 No 2 pp 4.

Nichols, Paul (1991) Social survey methods. A field guide for development workers. Development Guidelines. No. 6. Oxfam, United Kingdom.

NPC (2007) The Provisional result of the 2006 census. National Population Commission of Nigeria. Abuja, Nigeria.

Okereke, P and Udeagu E (2000); Water Resources Development in Eastern Nigeria. Owerri, Nigeria.

Owen, D. L (2006); Summer time blues-back to dirty realities. Global Water Intelligence (GWI); Market leading analyses of the international water industry. Vol.7 Issue 9 pp.7.

Raschid-Sally, L; Bradford, A.M; and Endamana, D (2003) “Productive use of waste water by poor urban and peri-urban farmers: Asia and African case studies in the context of the Hyderabad Declaration on Wastewater use” in Patrick Moriarty et al (eds.) (2004) pp.96-116.

Robinson, Peter; Matthew, Brian; Proudfoot, David.(2004)”Productive Water Strategies for Poverty reduction in Zimbabwe” in Patrick Moriarty et al (eds.) (2004) pp.173-196.

Sansom, Kevin(undated) Water Utility Management. Unpublished MSc lecture notes, WEDC: Loughborough University, Loughborough, UK.

Skinner, B.H (2006) Rainwater Collection. Unpublished MSc lecture notes, WEDC: Loughborough University, Loughborough, UK.

Smits, S; Renwick, M; Renault, D; Butterworth, J and van Koppen, B (2008) From practice to policy: background paper for the symposium on multiple –use services, International Symposium on Multiple-Use Services, Addis Ababa, 4-6 Nov 2008.

UNECA. (1999); United Nations Economic Commission for Africa (UNECA). Integrated Water Resources Management; Issues and options in selected African countries. Addis Ababa, Ethiopia.

Van Koppen, Barbara, Moriarty, Patrick., and Boelee, Eline (2006) Multiple –Use Water services to Advance the Millennium Development Goals. International Water Management Institute Research Report 98, Colombo Sri Lanka.

WWDR 2 (2006), Human Health in Water Development (The United Nations World Water Development Report2) UNESCO; Paris, France.

Keywords

Nigeria, productive, household, utility, sustainability, wastewater.

Contact details

Joachim Ibeziako Ezeji
Rural Africa Water Development Project (RAWDP),
58 MCC/Uratta Road, Owerri, Nigeria.
Email: joachimezeji@yahoo.com
www.joachimezeji.com

Ian Smout
WEDC, Loughborough University, UK.
I.K.Smout@Lboro.ac.uk