**Delft, The Netherlands, 19-21 November 2008**

IRC SYMPOSIUM : SANITATION FOR THE URBAN POOR
PARTNERSHIPS AND GOVERNANCE

# Productive Use of Domestic Wastewater in Peri-urban Regions
## *Issues and Options*

*Mathew Kurian, Ratna Reddy, M. Rao, Sneha Lata*

*Sanitation has emerged as an important development challenge especially in secondary towns experiencing higher rates of urbanization but with relatively limited financial resources to be able to construct sophisticated underground drainage systems. Peri-urban wastewater re-use has a high cost-benefit ratio given its usefulness in facilitating freshwater swaps, reducing energy intensity of agricultural systems and facilitating community adaptation to climate change induced public health and environmental risks associated with storm drain overflows and contamination of drinking water sources respectively. But for domestic wastewater to be put to productive use institutional incentives must be identified for collection, transport, treatment and reuse. This paper argues that it is important to examine the potential benefits of wastewater reuse within a broader political economy context of competition for water between agriculture and urban water supply. Further, it is also important to emphasize spatial integration of water supply and sanitation to address disparties in access to water supply and sanitation services between rural and urban consumers. The paper reviews international experience to argue that decentralization is a necessary but insufficient guarantee of improved service provision. Important considerations within a decentralized policy framework that merit attention include seperation of roles between regulator and service provider, coordination between rural and urban local governments and public line departments and private sector and improved information flows to facilate effective local level planning in support of improved access to basic services.*

## 1. Introduction

According to World Health Organization's definition of improved sanitation, 2.6 billion people worldwide do not have access to either a public sewer, connection to a septic tank, a pour flush latrine, a simple pit latrine or a ventilated improved pit latrine (SEI, 2008, UNDP, 2006). More than 4 billion people will need to gain access to basic sanitation to meet the 2025 Millennium Development Goal (MDG) target for universal coverage. With increasing levels of economic growth and demographic transformation peri-urban regions are fast becoming an important focus of the sanitation challenge (UN Habitat, 2005). Secondary towns are beginning to thrive as centres of minor manufacturing and in-migration from rural areas is on the rise as people come in search of employment. Agricultural land is being converted into commercial property and the price of land is rising. With rising economic activity and in-migration into secondary towns, levels of wastewater generation from hotels, hospitals and residential centres is rising. In many cases wastewater goes untreated contaminating river systems that serve as a source of drinking water for rural habitations situated further downstream. In other cases untreated

wastewater is used for productive purposes[1] by villages on the rural fringe[2]. Climate variability (*reflected for instance in seasonal or annual variation in rainfall patterns*) poses risks of crop losses and outbreak of intestinal diseases in the wake of flooding caused by overflow of storm water drains. Productive use of domestic wastewater with its emphasis on collection that stabilizes seasonal water flows, storage that ensures effective dilution to mitigate adverse health impacts and reuse emerges as a risk management option in peri-urban regions.

Most previous analyses of wastewater have tended to focus on agricultural reuse potential in developing countries (Rashid et.al, 2005). Further, studies of water quality and wastewater treatment technologies have received considerable attention in order to understand the health impacts of wastewater agriculture (Blumenthal, 1999). But a number of institutional constraints remain unresolved: (a) Inter-governmental transfer mechanisms that effectively couple public water supply and sanitation service provision, (b) identification of sanitation management interventions with a higher benefit-cost ratio and (c) design of peri-urban sanitation plans with an emphasis on equity, subsidiarity and clear deliniation of roles between regulator and service provider (World Bank, 2006). The objectives of this paper are therefore threefold: (a) To illustrate the links between water supply and peri-urban sanitation, (b) To highlight governance issues relating to decentralization and unbundling of water supply and sanitation services and (c) To outline issues and options focussed on building capacity for priortizing sanitation management interventions, planning for their implementation and monitoring their impact on the poor and environment.

The following sections of this paper are organized as follows. Section 2 describes the links between peri-urban wastewater and water supply by discussing issues relating to water allocation, unaccounted water and pathways of human exposure to pathogens from wastewater. Section 3 reviews international experience with governance of peri-urban wastewater. Issues relating to inequities in rural-urban water supply, decentralization and unbundling of services, importance of institutional coordination and information flows in local planning are discussed. A *learning by doing* approach is proposed to identify the specifics of service deregulation in a decentralized policy environment. Section 4 uses the example of India to explore possibilities for Corporate Social Responsibility (CSR) in furthering guidelines laid out in the new urban sanitation policy of the Government of India through formation of Peri-Urban Partnerships. Important policy conclusions are drawn in the final section of the paper.

[1] Productive uses of domestic wastewater may include its use in kitchen gardens, livestock and poultry rearing and minor irrigation. Planned reuse of wastewater could be for direct or indirect purposes. Direct reuse could include potable use as in Singapore and Namibia. Direct re-use could also include non-potable purposes such as agriculture, urban and industrial as in Israel, Australia and USA. Indirect reuse could be for potable purposes through aquifer injection for controlled groundwater recharge as practiced in Australia and USA. Unplanned reuse on the other hand could take the form of direct non-potable like agriculture directly from a sewage system as practiced in most developing countries (Keremane and McKay, 2007).

[2] It has been estimated that 20 million hectare is directly or indirectly irrigated with wastewater in fifty countries- close to ten percent of total irrigated areas (Rijsberman, 2004). A national survey of Pakistan showed that one-third of all wastewater produced in the country is used directly, undiluted and untreated for irrigation and an estimated quarter of all vegetables grown in the country are irrigated with wastewater. But concerns have been expressed about the health effects of using wastewater for minor irrigation (Scott et. al, 2000). But a study in Pakistan's Haroonabad district concluded that some of the potential health risks of using wastewater for agriculture can be mitigated by conjunctive use of irrigation water (Wim Van der Hoek et.al, 2002). However, changes in farm practices and cooperation between municipal authorities and farmers over sharing of wastewater and management of storage facilities for proper mixing of both water sources would be a prerequisite (Ensink, et. al, 2002).

## 2. Peri-urban Water and Sanitation

### Water Allocations

The total amount of water required for domestic water supply is small compared to water required for agriculture[3]. Some argue that there is no real competition for water between domestic water supply and other uses, both because the amounts of water involved are so small and because water for domestic purposes is of such high value that the clearer the priority that is should take precedence over the other uses. Globally roughly 10 percent of all water diverted for human purposes is used for domestic purposes, 20 percent for industrial uses and 70 percent for agriculture. Therefore, one may argue that there is sufficient water in the world for domestic purposes, industry and even to produce food, but that these water resources are distributed unevenly. In the future the skewed nature of water allocation is bound to be influenced by rising urbanization and there are indications that this trend could result in a reduction in agricultural water deliveries. The political economy of water allocation in India, for instance is such that it is estimated that freshwater agricultural deliveries could decline from 85 percent in 2002 to 77 percent in 2025 on account of rising demand for water supply in cities (IWMI, 2007).

### Influence of Climate Variability

Freshwater withdrawals from aquifers and rivers constitute an important source of urban water supply. Rural water supply agencies in developing countries typically respond to rising agricultural water demand by transiting from single village piped schemes (that rely on surface water sources like rivers) to multi-village piped schemes that pump water from relatively greater distances. Another option has been to drill bore wells that pump water from underground aquifers. Both multi-village piped schemes and groundwater- based schemes tend to involve rising input costs (energy) and result in environmental costs like declining water tables (EPW, 2007). Rainfall variability further compounds the challenge by reducing freshwater availability from surface and groundwater sources as a result of lower recharge of aquifers (World Bank, 2008). Given the fact that approximately eighty percent of water supplied to urban centres is converted into wastewater[4] there are substantial environmental and public health risks posed by seasonal overflows of storm drains, wastewater stagnation and contamination of rivers. Incidentally, a global review of possible water supply and sanitation interventions found reuse of peri-urban wastewater to have the highest benefit-cost ratio among all considered options (*Table 1*). A cost-benefit analysis of peri-urban wastewater under conditions of rainfall and temperature variability in Karimnagar, India (a town with a population of 0.2 million) revealed additional annual benefits (reduced health risks and lower use of fertilizers) from improved management of wastewater to be in the range USD 1,85,000 (WSP, 2008).

[3] Poor people that do not have washing machines, cars to wash or gardens to water need 20-50 litres of water per person per day for domestic purposes. People in Europe generally use some 200 litres per person per day while in USA the figure is about 400 litres. In addition, all people require thousands of liters of water per day to produce their food, depending on their diet and lifestyle. To produce 1 kg of cereal grains requires about 1000 litres of crop evapotranspiration. However, 1 kg of meat requires much more water to produce- depending on how much feed is given to the animals versus animals that graze on rainfed pastures. In California for example, about 13,500 litres of water is used to produce 1 kg of beef. A typical diet of a person in the USA requires about 5, 400 litres of water in the form of evapotranspiration. On the other hand a vegetarian diet with approximately the same nutritional value is responsible for the consumption of 2,600 litres of water per day. In addition, upto 90 percent of the water provided to people for domestic purposes is returned after use as wastewater and can be recycled, while most of the water (40-90 percent) provided to agriculture to grow food is consumed (evapotranspired) and cannot be re-used (Rijsberman, 2004:499).

[4] Domestic wastewater constitutes the largest percentage of wastewater generated- larger than industrial and agricultural wastewater (IWMI, 2007). Further, grey water (water from bathrooms and kitchens) constitutes the largest share of domestic wastewater compared to black water (water from toilets) (Jimenez, 2008).

**Table 1: Costs and Benefits of Water- Related Opportunities (bn US$)**

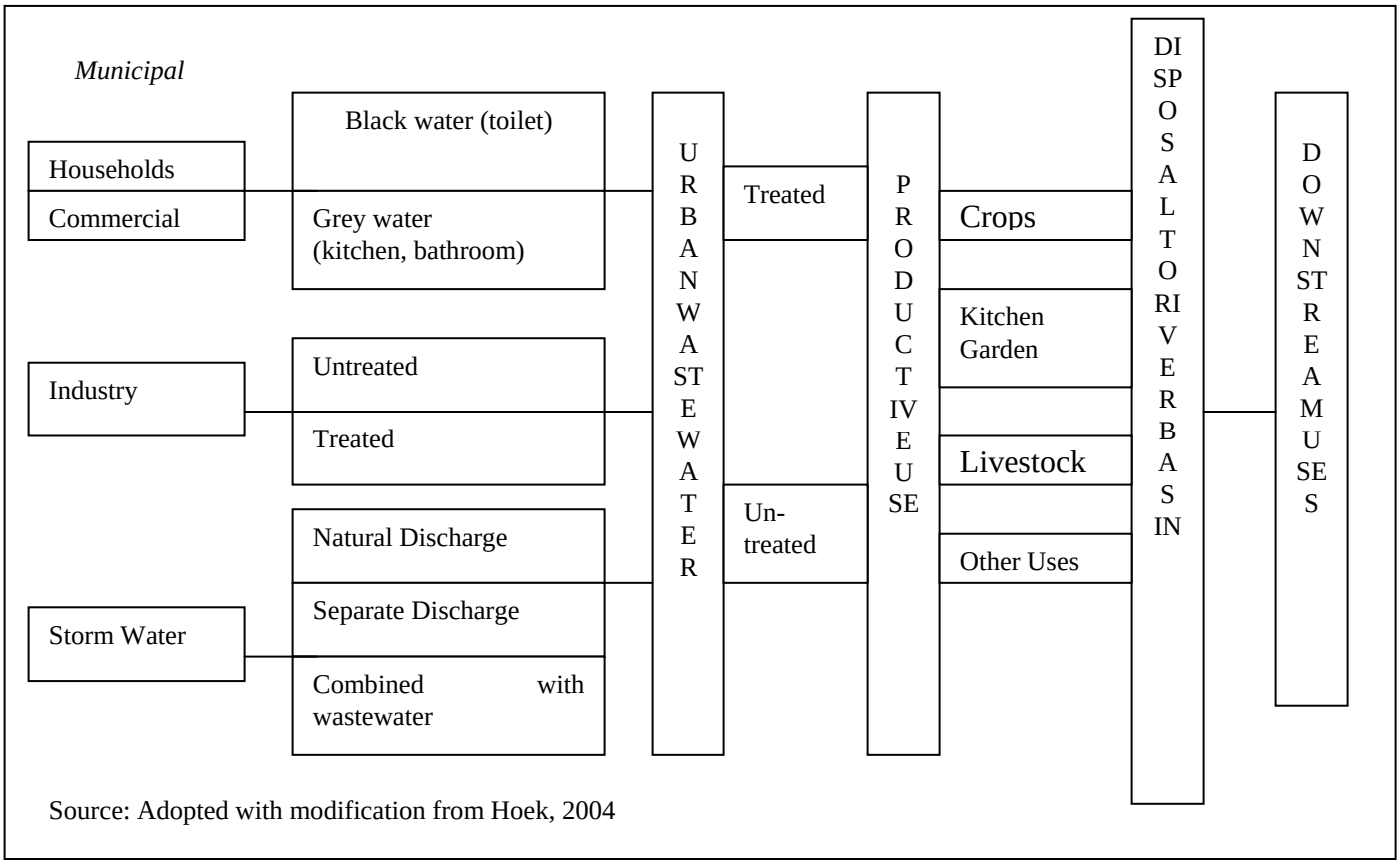
| Water Opportunities | Total benefits | Total costs | Annualised B/C | Discount Rate/remarks |
|---|---|---|---|---|
| Community managed low-cost water supply and sanitation[5] | 392 | 80 | 4.9 | 10% |
| Small scale water technology for livelihoods[6] | 502 | 102 | 4.9 | 5% |
| Reuse of wastewater for peri-urban wastewater | Very high | Medium | Very high | - |
| Sustainable agriculture in wetlands | Medium | Small | High | Focus on Africa |
| Research to increase water productivity in food production | Very high | Very small | Very high (15-20) | - |

Source: Rijsberman, 2004

### Pathways of Human Exposure to Pathogens from Wastewater

There could be multiple pathways though which pathogens find their way into water bodies (*Figure 1).* People get affected through direct consumption (drinking water, eating products like grains, vegetables, fish, etc) or contact with water (bathing, washing, cleaning, etc). The impact of direct consumption is termed as water borne and through contact is termed as water washed diseases.

**Figure 1: Typical Wastewater Cycle**




Source: Adopted with modification from Hoek, 2004

[5] Annualised costs for the period 2004-2015

[6] Multiplier for indirect benefits assumed as 3

In rural areas households mostly depend on the local surface or groundwater sources. In some cases water from these sources are treated and supplied as a public service. In others people process the water in order to make it potable. In some instances people consume contaminated water due to lack of awareness regarding water pollution. For, surface and groundwater bodies often get polluted through non-point sources, which are not conspicuous in general. While pollution due to domestic wastage and industrial effluent discharges into surface water bodies is more conspicuous, their seepage into groundwater aquifers is less conspicuous. Similarly, agro chemicals such as nitrate, pesticides, etc., contaminate surface water bodies through runoff and groundwater through seepage are less understood (Bhatnagar and Sharma, 2002). In general people determine the quality of water by its turbidity (colour), smell and taste. In the absence of such indications people tend to consume irrespective of the water quality. In the absence of alternative choices people are forced to consume water irrespective of its poor quality indicators. Choices are often limited due to low-income levels of the community or sections of the community or the physical or geographical attributes of the location. As a result of consuming poor quality of water people incur costs that vary depending on location (upstream-down stream), nature and intensity of pollution and climate variability (high rainfall / low rainfall regions).

## 3. Governance of Peri-Urban Wastewater- Issues and Options

### Coupling Water Supply and Sanitation Policy Priorities

Although potential exists to facilitate productive uses of domestic wastewater in peri-urban regions a planning framework that outlines specific roles and responsibilities of local governments (*asset owners*) and private sector (*potential service providers*) still needs to be identified. New configuration of roles for regulators also needs to be evolved to set prices and monitor service standards. Important policy guidelines that could facilitate successful coupling of wastewater reuse and sanitation needs to be evolved to cover the following issues:

- Source separation of black and grey water
- Retrofitting of toilets to optimize on water use
- Establishment of sewage treatment facilities that maximize on economies of scale,
- Improving rates of household connection to sewer networks
- Dovetailing storm drains with condominial sewer systems.

### Decentralization and Service Provision

Decentralization provides a broad policy framework and principles that circumvent the technical, managerial and policy challenges relating to wastewater in peri-urban regions (*Table 2).* There is a general assumption that greater administrative and political decentralization involving transfer of responsibilities would empower lower governments and thereby improve access to basic services for the peri-urban poor. But there are indications that this is not a foregone conclusion (Allen et. al, 2006). For example, in the wake of a decentralization process in Venezuela some municipalities were reluctant to accept added responsibility (often restricted to distribution and customer service) even if their role was one of regulating and administering a water and sanitation concession to a third party (such as a private sector or a public-private partnership) (*see box 1*).

**Table 2: Peri-urban Wastewater – Overview of key Institutional Challenges and Options**

| Policy Priority | Technical | Management | Governance |
|---|---|---|---|
| 24/7 Water supply | ❑ Water pressure<br>❑ Hydraulics- pressure & flow<br>❑ Pipe diameter<br>❑ Quality | ❑ O&M of multiple use water systems<br>❑ O&M manual<br>❑ District Management Area<br>❑ Outsourcing service functions | ❑ Setting service standards<br>❑ M&E<br>❑ Demand responsive capacity development<br>❑ Policy guidelines on PPP, and institutional role separation |
| Rates of unaccounted water | ❑ System leaks/bursts<br>❑ Drainage patterns<br>❑ Seasonal fluctuations in water availability<br>❑ Wastewater accumulation points | ❑ Apparent losses<br>❑ Illegal connections<br>❑ Service management compacts | ❑ Mechanisms for integrated planning and implementation involving urban and local governments, line departments, and public and private sectors |
| Connection to sewer system | ❑ Source separation of black and grey water<br>❑ Retrofitting of toilets | ❑ WW collection, storage and cost-effective treatment<br>❑ Organization of re-use community<br>❑ Benchmarking | ❑ Sewerage tax- fiscal transfer mechanisms to compensate for negative externalities<br>❑ Viability of local government proposals to dovetail storm drains with condominial sewer systems |
| Sustainability of water supply sources | ❑ Trends in rainfall/temperature<br>❑ Soil and water conservation interventions<br>❑ Evapotranspiration<br>❑ Water quality links<br>❑ Health impacts of WQ<br>❑ Land use patterns | ❑ Assessment methods<br>❑ Viable groundwater management unit<br>❑ Information flows<br>❑ Rules for runoff, transformer performance, water diversions, sanctions for non-compliance, group borewells, publicizing maximum well depths | ❑ Water allocation<br>❑ Energy pricing & subsidy structures<br>❑ Water rights<br>❑ Role clarity and accountability |
| Inter-Governmental Transfers | ❑ Valuation methods<br>❑ Performance indicators<br>❑ Meter quality<br>❑ Data handling | ❑ Cost-benefit analysis<br>❑ On spot billing<br>❑ Service provision contracts<br>❑ Participatory assessments | ❑ Ring fenced public accounts<br>❑ Norms that link IGT's to achievement of policy outcomes<br>❑ Cost recovery<br>❑ Human resources- salaries & recruitment<br>❑ Business/revenue models |

## Box 1: Typology of Public-Private Service Provision Models

*Service Contract:* restricted provision for technical services through simple service contracts, where the public authority retains overall responsibility for operation and maintenance of the system, except for the specific, limited scope services that are contracted out

*Management Contract:* contracted company is transferred responsibility for entire operation and maintenance of a system and is paid a fee to operate water supply and sanitation services

*Lease Contract:* private company leases the water supply and sanitation assets and maintains and operates it, in return the right to water and sanitation revenues, while the public authority remains the sole owner of the assets

*Concession:* private contractor has overall responsibility for services including operation, maintenance and management as well as capital investments for expansion of services, while the public authority retains overall responsibility to regulate operations of the private operator and

*Divesture:* private operator is given full responsibility for operations, maintenance and investment and legal ownership of assets are transferred to the private company

Source: Water and Sanitation Program, 2008

Across Australia a single state owned utility is responsible for water supply and sewerage services. The local governments are primarily responsible for water supply and sewerage boards in New South Wales, Queensland and Tasmania. The state of Victoria (excluding Melbourne) offers the only example of a regional utility model in which more than one utility exists and each of them services multiple local governments (Keremane and McKay, 2007). With respect to ownership and operations, local governments own all the utilities in Australia. While there has been little privatization in the water sector (with exception of irrigation), there has been restructuring and institutional role separation within public sector departments. The public sector departments have been transformed into corporations, subject to the same laws that govern the private sector, and with clear commercial objectives. Further, a number of water utilities have contracted out their design, construction and various operational roles to the private sector through service or management contracts (*see box 2*).

In addition to unbundling of service provision functions, regulation of prices and service standards is important. Australian experience highlights a clear shift towards independent regulation and most of the states and territory jurisdictions favour a multi-sector approach. For health regulation in almost all states the health department controls compliance with national water quality standards. Environmental regulation comes under Environmental Protection Agency. Proper pricing of rural and urban water is one of the key issues for reform of the Australian water industry. All states have adopted a two- part water tariff for water provision constituting of a fixed access fee and a charge for usage. Sewerage charges are generally fixed. On the other hand experience with Vietnam's evolving decentralization experience highlights the role of ward level committees in enforcing technical standards for water supply in Haiphong county (WSP, 2008).

## Box 2: Outsourcing of Operational Functions: Billing and Collection, Singapore

Billing and collection systems in Singapore are also referred to as the Customer Management System and have been outsourced by the Public Utilities Board to SP services. Since 1995, SP services has been providing one-stop services for three services- water, electricity and gas- and includes storage of master data (accounts, addresses, meter data) bills and consumption records, meter reading records and managing abnormalities in consumption. A consolidated bill for all three services is sent to every household account every month. Bills are sent within 10 days of actual or estimated meter reading and can be paid through multiple channels like checks, credit cards, internet and kiosk machines. SP Services collects the payment and remits it to the PUB on a daily basis, along with a daily remittance report. A month's reconciliation is also sent to the Board and any difference is remitted or deducted from the subsequent daily remittance. SP Services also helps the Board with debt management. It conducts a series of debt collection efforts and only when all means are exhausted does it submit a quarterly bad debt report to the Board. The debt collection efforts include calling customers, pink notices, reminder letters and imposition of a 1 percent monthly late charge. SP services has also set up customer service centers for facilitating opening or closing utility accounts, handling queries of accounts and billing and bill payments.

Source: Water and Sanitation Program, 2008

A learning by doing approach based on integrated, pro-poor, cost-effective and participatory principles is a prerequisite to identifying the nuts and bolts of unbundling of services. Ultimately customer compliance with institutional rules relating to operations and maintenance of water supply and sanitation services will reflect robustness of governance arrangements. In this connection Van Dijk (2003) based on an international review of successful water utilities identified the following characteristics of robust governance arrangements: water sector reform programme with an independent regulator, legal status of utility, price of water based on cost recovery, pro-poor targeting of public subsidies, continuing emphasis on efficiency and productivity, choice to go for multi-utility firm and for unbundling, promotion of technological innovation, transparent tendering process, possibility to cut off connections to water supply and sanitation services and scope for PPP through commercial orientation.

*India's Experience with Decentralization- What Lessons for WSS Service Provision?*

India's decentralization program is now fifteen years old and there are important lessons to be drawn with regard to water supply and sanitation service provision (Urban Finance, 2007). The *Constitutional 74$^{th}$ Amendment Act. 1992* devolved responsibility for preparation of plans for economic development and implementation of development schemes to "municipalities" as constituted by article 243Q. The Twelfth Schedule lists matters for which municipalities have responsibility to implement development schemes. Article 243W- *Twelfth Schedule* lists water supply for domestic, industrial and commercial purposes together with public health and sanitation conservancy and slum improvement and upgradation as items for which municipalities are responsible. *The Water (Prevention and Control of Pollution) Act. 1977 (No. 36)* entrusts "local authority" (municipalities) the duty of supplying water under law besides responsibility for sewerage-inspection of treatment plants, disposal, effluent standards, utilization of sewage in agriculture etc. Local authorities may give directions regarding abstraction of water from a stream or well in an area and for sewerage disposal into such a stream or body. The *Action Program for the Eleventh Plan* calls for setting up a District Planning Committee (DPC) to work out mechanisms for joint programs to be financed by State government institutions and joint contributions by urban and rural local bodies.

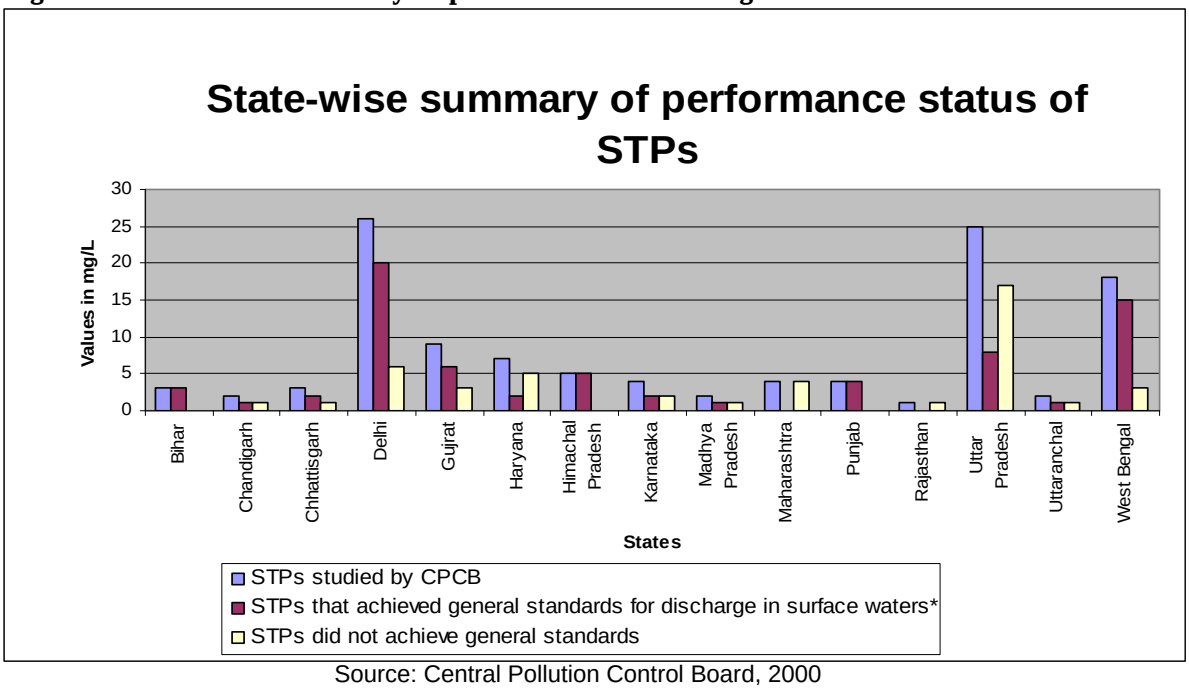
Indian experience suggests that the exact form that unbundling of service provision functions should take would depend on sector specific policy objectives and local political economy. Important political economy and environmental challenges include the following:

- Inequities in distribution of water supply and sanitation between urban and rural consumers[7]
- Negative externalities arising from wastewater generated in urban centres[8]

### Lack of Institutional Coordination

Peri-urban regions pose a challenge to implementation of effective water supply and sanitation services within a decentralized policy environment. This is primarily because of a lack of coordination between urban and rural local governments and line departments (like irrigation and public health). Coordination becomes extremely important in facilitating productive use of domestic wastewater in the context of municipal expansion, rising property and energy prices and land use conversion and modification. At present line departments tend to favour sewage treatment technologies that are not necessarily economically viable. Local governments with limited power to raise their own revenues and little accountability for funds they receive from centrally sponsored schemes have tended to channelize resources towards costly sewage treatment facilities that in a large number of cases do not function to capacity (*Figure 2*). In other cases a very small proportion of total households actually connect to them for a variety of reasons ranging from cultural ones to economic affordability. Proponents of Multiple Use System (MUS) approaches have pointed out that improved coordination between local governments and line departments could go a long way in addressing challenges like those posed by wastewater in peri-urban regions. Adopting a MUS approach to wastewater in peri-urban regions could have the benefit of converting wastewater from a sanitation challenge to an opportunity with enormous reuse potential through a focus on simple modifications in design of water delivery technologies and storage infrastructure (Van Koppen et. al, 2006).

**Figure 2: State wise summary of performance of Sewage Treatment Plants in India**




Source: Central Pollution Control Board, 2000

[7] In India, for instance, urban areas have a higher stipulated Litres Per Capita Daily (LPCD) water supply compared to rural areas. Due to growing contamination of surface water sources (like rivers) rural habitations are relying on private sources of water (tankers and bottled water) and may end up paying higher when compared to urban consumers of piped water supply systems. Further, a smaller proportion of poorer households have access to flush toilets and either use community toilets or septic tanks that are poorly serviced by local authorities.

[8] Longitudinal poverty studies have identified that expenditure on health is the single most important factor responsible for the descent of households into poverty. Health expenditures primarily arise from contamination of drinking water sources and unsafe sanitation practices (Krishna, 2008). A recent WSP study on the economics of sanitation in Indonesia is revealing in this regard (WSP, 2008).

### Information Flows and Local Planning

One of the probable reasons for less than optimal decision making with regard to sewage treatment could be the infrastructure of information flows[9]. First, there are shortcomings in the methodologies relating to assessment of water balance, estimation of extraction and recharge rates, water quality sampling and access of poor to services. Further, in peri-urban regions there is little or no information sharing between different levels of government and line departments (*Box 3*). Further, in peri-urban regions capacity for data analysis and informed decision making by local governments is limited. District Planning Committees were supposed to professionalize the planning process by improving coordination between urban and rural local governments and by linking disbursement of funds from higher tiers of government to local governments to achievement of policy outcomes like reliable water supply, reduction in rates of unaccounted for water, increased household connections to sewer systems, source sustainability of water supply sources and improved rates of cost-recovery for WSS projects. But in reality only the state of Kerala has a well functioning DPC as a result of which local government capacity to conceive of plans for collection, cost-effective treatment and safe disposal of wastewater for productive purposes is limited. In the absence of detailed local plans for management of sewage rates of disbursement of central funds by local governments remains low[10].

Kerala is one of the states that have taken steps to operationalize local government planning in design of schemes financed out of State funds. But even here institutional shortcomings are evident. Centrally Sponsored Schemes (CSS) are outside the purview of Kerala's decentralized planning framework since they are implemented directly by Collector (at district level), Block Development Officer (at block level) and GP Secretary (at GP level). Other shortcomings of the Kerala decentralization include the multiplicity of funds from other sources: centrally sponsored schemes, departmental schemes, Member of Parliament (MP) scheme and Member of Legislative Assembly (MLA) schemes. Could these schemes have the effect of "crowding out" the spirit of decentralized planning reflected in devolution of funds to Gram Panchayats? Given devolution of funds and responsibility for project implementation to GP's, the development Block is increasingly being viewed as a redundant element of the decentralized planning structure. Moreover, GP's are faced with a shortage of technical staff from line departments given the enormous number of projects that are now being implemented directly at the grassroots. Although nothing prevents GP's from outsourcing various aspects of project implementation to private players, given the political economy of Kerala, this option is rarely exercised due to fears of allegations of corruption that can be leveled against members of local governments. Although 40 percent of "service sector" funds *(includes water supply and sanitation*) are at the disposal of GP's, a large number of them come tied with conditions on how they can be spent. But the reflecting the true spirit of decentralization people's preference for road construction is reflected in a high proportion of "infrastructure sector" expenditure. An important policy question that could be posed in this context is: to what extent is this trend reflective of a broader rural-urban transformation process that is buttressed by Kerala's long history of labour migration?

---

[9] Information flows serve the purpose of influencing public perception of wastewater, its reuse potential and eliciting public participation in management (Keremane and McKay, 2007). Public perception of benefits of wastewater management and community participation in minimizing adverse health impacts play an important role in defining willingness to pay for services. Irrigation studies have pointed out that when the State meets up front costs of infrastructure construction local leaders may emerge to ensure provision through service contracts (Kurian and Dietz, 2007). Effective information flows are important in this process since it catalyzes activities like communicating details relating to contracts between public and private sectors, incorporating of community inputs in design of interventions and creating consensus between different stakeholders with the ultimate goal of realizing desired policy outcomes (World Bank, 2004)

[10] A study of functional devolution to local governments found that devolution percentages for expenditure that is devolvable are uniformly low for public health, minor irrigation, drought relief and water supply (Rajaraman and Sinha, 2007). By contrast for sectors like rural development with a preponderance of schemes where the central government lays down strict rules on how such funds may be used, devolvable percentages tended to be higher (for. eg, employment generation).

### Box 3: Integrated Service Delivery Centres through E-Seva (Internet), Andhra Pradesh, India

E-Seva is an e-governance initiative of the Department of Information and Technology and Communication, Government of Andhra Pradesh which provides integrated services in urban areas with the objective of simplifying collection procedures by providing citizens with a one-stop shop for a variety of government to citizen and business to citizen services. The prerequisite for government departments to join the service in the pilot phase was the presence of an online database system and the readiness to allocate surplus bill collection staff to man the e-seva centres. The services were provided by connecting databases of respective departments using Integrated Services Digital Network lines on a real-time basis. Two private technology companies development the application software and maintained the backend databases. The initiative was implemented on a Private-Private Partnership (PPP) through a "Build, Operate, Own and Transfer" (BOOT) model for a five year period, with the private technology partners provided the necessary hardware and developed and maintained the interface software. The private partners were responsible for providing human resources to man the e-seva centres, for which they were reimbursed separately by the state government. The replication in the districts had similar institutional arrangements, with three private technology partners chosen in September 2002 for setting up district data centres, installing hardware and the network, and maintaining the citizen service and data centres thereafter. The state government met the entire cost of the project for all phases and facilitated the provision of the building and infrastructure required for the citizen service and data centres.

Source: Water and Sanitation Program, 2008

## 4. Productive Use of Domestic Wastewater- A Framework for Action

### Facilitating Integration, participation and Institutional Coordination

Institutional mechanisms that facilitate coordination between rural and urban local bodies and multiple line departments are crucial to overcoming the shortcomings of existing approaches to wastewater management in peri-urban regions. Critical to overcoming institutional fragmentation is the need to develop a planning framework that would facilitate integrated, decentralized, pro-poor and participatory planning by local governments in support of effective technical interventions for sewerage service provision. One of the outcomes of a system of iterative planning is that risks relating to water borne diseases, seasonal water shortages and economic losses arising from seasonal flood damage could be reduced. The draft National Urban Sanitation policy that is currently before the Union Cabinet has outlined a national award scheme to promote the concept of totally sanitized cities. A key feature of the award scheme relates to preparation of baseline surveys, development of a city sanitation plan and its implementation. The policy states that state governments may facilitate this process by instituting a state level incentive/award scheme to promote competition amongst urban areas within the state.

Van Dijk (2003) underscores the importance of the following utility level performance indicators that could prove useful in designing an effective incentive/award scheme:

- Solvency ration (equity capital to total capital)
- Yield to assets
- Efficiency as connections per personnel
- Price of a M3 of water
- Operating revenue as a percentage of operating costs
- Unaccounted for water
- Revenue collection efficiency
- Coverage of water supply and sanitation services
- Service to poor people/neighbourhoods
- Productivity

### A Corporate Role in Development & Implementation of City Sanitation Plans?

Previous experience with Community Led Total Sanitation (CLTS) in South Asia for instance, suggests that a catalyst is required to facilitate a process of competition between local governments in pursuit of policy outcomes relating to water supply and sanitation (WSP, 2007) (*Box 4).*

**Box 4: Key Features of CLTS Approach**

***Collective Action***
Mobilizing the community rather than establishing household contacts

***Local Choice***
Accommodating a variety of technological options and getting people to assess affordable technologies

***Setting up Appropriate Institutional Frameworks***
Giving local governments a central role in scaling up and sustainability of CLTS approaches

***Incentive Structure***
Directing Incentives to the community and rewarding outcomes, rather than subsidizing construction of household toilets

***Market Development***
Promoting development of markets for sanitary material and allowing private suppliers to respond to demand

Source: Water and Sanitation Program, 2007

An external consultant driven approach does not necessarily ensure buy in from local stakeholders. Instead local governments could be encouraged to utilize resources at their disposal to undertake development of plans and arrange for their implementation[11]. In return for visibility (*through websites, print and electronic media, Confederation of Indian Industry (CII) sponsored events*) corporate houses could be approached with the idea of catalyzing a process of local level planning and implementation of sanitation plans in peri-urban regions. In a sense this would mark a progression from the conventional Corporate Social Responsibility (CSR) approach where the focus has typically been on local communities impacted by the plant. Encouraging corporate houses to make the transition from *plant to plan* may also offer them an opportunity to build trust with local governments as a precursor to showcasing appropriate technologies relating to water and sanitation.

CSR may have a role to play in operationalizing the concept of totally sanitized cities through establishment of Peri-Urban Partnerships (PUP's) composed of representatives of urban and rural local bodies (*Box 5*). PUP's could play the role of prioritizing wastewater management interventions, planning for their implementation and monitoring the impact of interventions on the environment and poor in urban slums and rural habitations. But for PUP's to be effective their performance is best monitored by a third party entity- eg. CII. In the medium to long term corporate houses could be rated for their performance of this local planning and implementation role. CII could play a facilitation role in designing a PUP rating system for select towns, design advocacy and communication strategies and support capacity building initiatives that support institutionalization of participatory planning processes within local government planning structures. Examples of capacity building initiatives could include support for a Trainer of Trainer (ToT) course module/planning manual on wastewater management for local government functionaries and representatives of line departments, scoping studies to identify potential for private sector investment in wastewater management treatment technologies and design of an annual award program for local bodies in recognition of steps taken in the direction of local level planning and implementation.

[11] One example of a centrally sponsored scheme emphasizing a local government role in sanitation is the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) for which guidelines were issued in 2005.

**Box 5: Key Milestones of Peri-Urban Partnerships**

**Milestone 1: Dialogue**

- State government and private sector agree on approach
- Rural and urban local governments agree on peri-urban sanitation plan
- Sector Departments- irrigation & PHED agree on framework for action

**Milestone 2: Benchmarking**

- Corporate houses facilitate establishment of PUP in select towns
- PUT's institutionalize advise to local bodies on wastewater management activities
- CII facilitates establishment of a PUP rating system for towns

**Milestone 3: Capacity Development**

- CII explores/facilitates ToT on WW management for MoUD
- CII explores/facilitates private sector investment in sewerage treatment technologies
- CII facilitates establishment of an annual award system for PUP's (CM)

International partners could support CII in this effort by responding to requests for technical assistance that could include: providing methodologies for wastewater assessments in peri-urban regions, development of a planning framework, preparation of a community consultation strategy and outlining a governance framework for taking productive use of peri-wastewater to scale. In the process of finalizing a governance framework studies may need to be commissioned to fill specific knowledge gaps (*examples: economic valuation of wastewater, identification cost-recovery models and service provision compacts that provide details of service standards/performance indicators and contract models*). International partners could support in a *demand responsive* manner requests for inputs from PUP's (*preferably routed through CII*). International agencies could also support concerned state government/CII through strategic inputs during planning and review of the final plans (*for example: inputs for preparation of policy guidelines, preparation of a planning manual*) and inputs into advocacy and communication strategy for PUP's and in line with GoI's proposed new urban sanitation policy.

## 5. Conclusions

Decentralization is a necessary but insufficient condition for improved access to sewerage services. We argue that institutional coordination involving rural and urban local governments and line departments is critical to ensure effective collection, treatment and reuse of peri-urban wastewater for productive purposes. Productive use of peri-urban wastewater for agriculture offers policy makers an opportunity to convert the sanitation challenge into an opportunity to improve livelihoods of the poor and protect the environment. It is important to recognize that effective wastewater planning and management is premised on integrated water resources planning and management- covering broader issues of water resources allocation, O&M of piped water schemes and IGT norms that link expenditure on infrastructure to an improvement in access to basic services. In this connection robust governance arrangements that emphasize institutional role separation between asset owner (regulator) and service provider, political commitment to cost recovery, promotion of technological innovation and private sector participation in fostering commercial orientation to service provision are helpful.

Government has an important role to play in identifying through a process of learning by doing the exact form that unbundling of services should take within a decentralized policy environment (Indian Infrastructure,

2008). Our review of experience from Venezuela, Australia, Singapore and Vietnam suggests that the private sector could play a role in facilitating productive use of domestic wastewater. In the Indian context the private sector could potentially play a role in operationalizing elements of the urban sanitation policy by supporting development and implementation of city sanitation plans. Given the multiple political and administrative entities straddling peri-urban regions we are optimistic of the role that corporate houses could play in facilitating dialogue, benchmarking of Peri-Urban Partnerships (PUP's) and capacity development in support of peri-urban water supply and sanitation planning and implementation.

An important policy principle that could be highlighted with reference to peri-urban wastewater is that of *equity*. Urban consumers are assured of a higher Litres Per Capita Daily (LPCD) water supply than their rural counterparts. But on the other hand rural inhabitants bear a greater cost due to contamination of drinking water sources as a result of improper management of urban wastewater. The important question that arises in this context is: how can rural consumers be compensated for the higher costs they are bearing on account of less than optimal water supply and sanitation service provision? Could rural local governments be compensated directly in the form of inter-governmental transfers from urban local governments or alternatively could urban local governments subsidize secondary treatment of urban wastewater to facilitate income generation through agricultural reuse? The principle of *subsidiarity* also needs emphasis to ensure that at different tiers of government links between (a) fund disbursement and policy outcomes, (b) capacity development and local demand and (c) role clarity and accountability[12] are strengthened. Finally, the principle of *regulation* needs attention especially with regard to issues like setting and enforcement of service standards, monitoring contractual agreements involving private players and public sector departments and removal of anomalies in peri-urban legislation relating to for instance- building bye laws that make safe sanitation practices mandatory, ability of local governments to raise their own revenue and determine expenditure and fiscal incentives for procurement of equipment and machinery used in wastewater treatment and piped water supply.

## References


Allen A. J. Davila and P. Hofmann. 2006. Governance of Water and Sanitation Services for the Peri-urban Poor, Development Planning Unit, University College, London.

Bhatnagar P.R and B.R. Sharma(2002), "Groundwater Pollution through Agricultural Practices and Agro Industries in India" IWMI – TATA Water Policy Research Programme Annual Partners' Meet.

Blumenthal U. 1999. Guidelines for Wastewater Reuse in Agriculture and Aquaculture: Recommended Revisions based on new Research Evidence, London School of Hygiene and Tropic al Medicine, London.

Ensink J. W. Van de Hoek, Y. Matsuno, S. Munir, R. Islam. 2002. Use of Untreated Wastewater in Peri-urban Agriculture in Pakistan: Risks and Opportunities, *Research Report 64*, International Water Management Institute, Colombo.

EPW. 2007. Half-solutions to Groundwater Depletion, *Economic and Political Weekly*, October 64019-20.

Government of India. 2006. Planning at the Grassroots- An Action Program for the Eleventh Five Year Plan, Ministry of Panchayati Raj, New Delhi.


[12] Network externalities, collective action problems and distribution goals provide powerful reasons for new accountability relationships. New accountability relationships are furthered through *voice*- citizens delegating to politicians the responsibility to ensure the infrastructure services they want. The second route is through *compacts* between policy makers and providers- to design service delivery framework, choose a provider, and ensure that it meets citizen expectations (World Bank, 2004).

Hoek W. 2004. "A Framework for a Global Assessment of the extent of Wastewater Irrigation: The Need for a Common Wastewater Typology", in Wastewater Use in Irrigated Agriculture, (Edited) C. Scott, N. Faruiqui and L. Rashid-Sally), CABI International.

Indian Infrastructure. 2008. Urban Water Financing- Riddled with Bottlenecks, Volume 10, pp. 70-71, National Institute of Urban Affairs, New Delhi

IWMI. 2007. Understanding the Drivers of Wastewater Agriculture in Developing Countries- Results from a Global Assessment, Comprehensive Assessment Research Report Series, International Water Management Institute, Colombo.

Jimenez B. and T. Asano. 2008. Introduction in Jimenez B. and T. Asano (*Edited)* Water Reuse: An International Survey of Current Practice, Issues and Needs, Scientific and Technical Report no. 20, IWA, U.K.

Keremane G. and J McKay. 2007. Water Transitions and Urban Wastewater Reuse in Australia: Lessons for Developing Countries, *International Journal of Environment and Development,* Vol. 4, no. 2, pp. 249-266.

Krishna. A. 2004. "Escaping Poverty and becoming Poor": Who Gains, Who looses, and Why? *World Development,* 32 (1), 121-36

Kurian M. and T. Dietz. 2007. Hydro-Logic- Poverty, Heterogeneity and Cooperation on the Commons, MacMillan, New Delhi

Rajaraman I. And D. Sinha 2007. Functional Devolution to Rural Local Bodies in Four States, *Economic and Political Weekly,* June 16, pp. 2275-2283.

Rashid- Sally, R. Carr and S. Buechler. 2005. Managing Wastewater Agriculture to Improve Livelihoods and Environmental Quality in Poor Countries, *Irrigation and Drainage,* 54 (Suppl. 1): 11-22.

Rijsberman F. 2004. Sanitation and Access to Clean Water, in B. Lomborg (Eds) *Global Crises, Global Solutions,* Cambridge University Press, London.

Scott C. J. Zarazua and G. Levine. 2000. Urban Wastewater Reuse for Crop Production in the Water-short Guanajuato River Basin, Mexico, *Research Report no. 41,* International Water Management Institute, Colombo.

SEI. 2008. The Sanitation Crisis, Econsan Res Factsheet 13, Stockholm Environment Institute, Stockholm.

UNDP. 2006. Beyond Scarcity: Power, Poverty and the Global Water Crisis, Human Development Report, United Nations Development Program, New York

UN Habitat. 2005. World Urbanization Prospects 2005 revision, New York.

Urban Finance. 2007. Impact of the Constitution (74$^{th}$ Amendment) Act on the Urban Local Bodies- A Review, Volume 10, no. 1, National Institute of Urban Affairs, New Delhi.

Van Dijk M.P. 2003. Liberalization of Drinking Water in Europe and Developing Countries, *Inaugural Address,* UNESCO-IHE Institute for Water Education, Delft

Van Koppen B, P. Moriarty and E. Boelee. 2006. Multiple-use Water Services to advance the Millennium Development Goals, *Research Report no. 98,* International Water Management Institute, Colombo

Wim H, M.Hassan, J. Ensink, S. Feenstra, L. Sally, S. Munir, R. Aslam, N Ali, R. Hussain and Y. Matsuno. 2002. Urban Wastewater: A Valuable Resource for Agriculture- A Case Study from Haroonabad, Pakistan, *Research Report no. 63,* International Water Management Institute, Colombo.

World Bank. 2008. Towards a Strategic Framework on Climate Change and Development for the World Bank Group- Concepts and Issues Paper, Consultation Draft, Washington DC

WSP. 2008. Economics of Sanitation- A Global Study, Washington DC, Water and Sanitation Program, The World Bank

WSP. 2008. Designing an Effective Leakage Reduction and Management Program, *Performance Improvement Planning Series,* Water and Sanitation Program, The World Bank

WSP. 2008. Developing Effective Billing and Collection Practices, *Performance Improvement Planning Series,* Water and Sanitation Program, The World Bank

WSP. 2008. Adapting to Climate Variability- Productive Use of Domestic Wastewater as a Risk Management Option in Peri-urban Regions, *Draft Report.*

WSP. 2007. Community Led Total Sanitation in Rural Areas- an Approach that works, Water and Sanitation Program, The World Bank

World Bank. 2006. Sector Strategy Implementation Update FY 05, Washington DC

World Bank. 2004. Making Services work for the Poor, World Development Report, Washington D.C.

---

Mathew Kurian
UNESCO-IHE Institute for Water Education

Ratna Reddy
M. Rao
Sneha Lata
Centre for Economic and Social Studies
Hyderabad, India