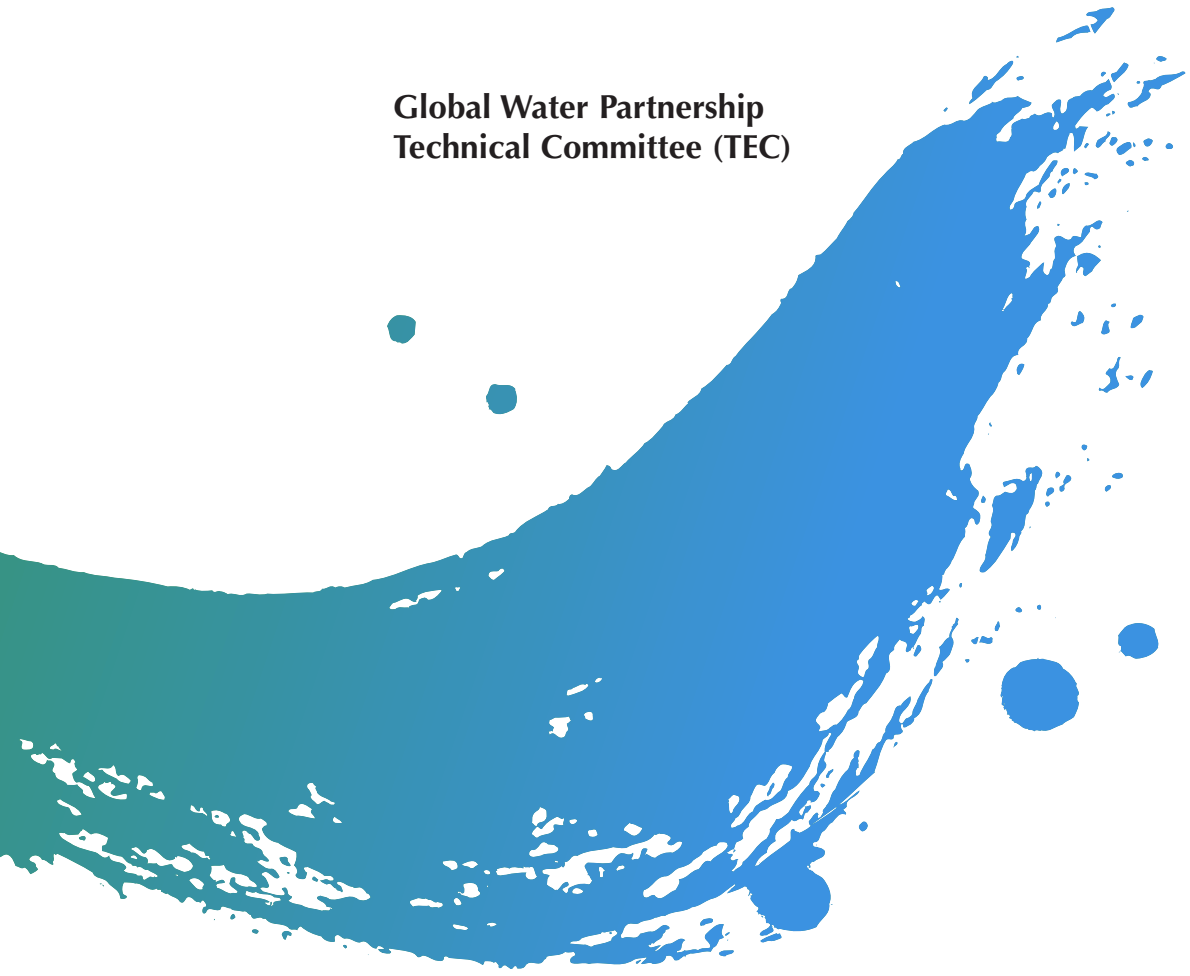
TEC BACKGROUND PAPERS NO. 11

Urban Water and Sanitation Services; An IWRM Approach

By JUDITH A. REES



Global Water Partnership
Technical Committee (TEC)

Global Water Partnership (GWP), established in 1996, is an international network open to all organisations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multilateral development banks, professional associations, research institutions, non-governmental organisations, and the private sector. GWP was created to foster Integrated Water Resources Management (IWRM), which aims to ensure the co-ordinated development and management of water, land, and related resources by maximising economic and social welfare without compromising the sustainability of vital environmental systems.

GWP promotes IWRM by creating fora at global, regional, and national levels, designed to support stakeholders in the practical implementation of IWRM. The Partnership's governance includes the Technical Committee (TEC), a group of internationally recognised professionals and scientists skilled in the different aspects of water management. This committee, whose members come from different regions of the world, provides technical support and advice to the other governance arms and to the Partnership as a whole. The TEC has been charged with developing an analytical framework of the water sector and proposing actions that will promote sustainable water resources management. The TEC maintains an open channel with the GWP Regional Water Partnerships (RWPs) around the world to facilitate application of IWRM regionally and nationally. The Chairs of these RWPs participate in the work of TEC.

Worldwide adoption and application of IWRM requires changing the way business is conducted by the international water resources community, particularly the way investments are made. To effect changes of this nature and scope, new ways to address the global, regional, and conceptual aspects and agendas of implementing actions are required.

This series, published by the GWP Secretariat in Stockholm has been created to disseminate the papers written and commissioned by the TEC to address the conceptual agenda. Issues and sub-issues with them, such as the understanding and definition of IWRM, water for food security, public-private partnerships, and water as an economic good have been addressed in these papers.

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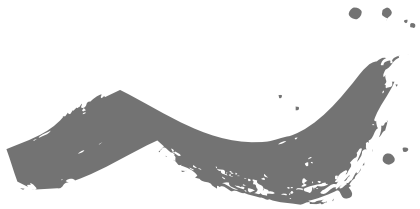

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ABSTRACT

The rapid pace and scale of urbanization represents a considerable challenge for water resources management, the delivery of essential water and sanitation services and environmental protection. To help meet these challenges there is a need to adopt an integrated water resources management (IWRM) approach which explicitly recognises the complex sets of interdependency relationships which exist within and between human and environmental systems. This need arises because of the negative externalities created by the uncoordinated use of water and land resources and by the uncoordinated provision of interdependent basic services; the opportunity costs of employing scarce water, land and capital for low value purposes; and the cost savings which can occur by widening the range of provision or management options.

An IWRM approach when applied in an urban context cannot simply consider matters within the built up area itself. It must recognise intersectoral competition for resources (physical, social and financial), the role of the urban sector in meeting national developmental priorities, and negative impacts of urban provision practices on other parts of the economy. IWRM does not imply the creation a vast bureaucracy attempting to coordinate everything, rather it involves the creation of an institutional framework within which water relevant roles and functions are performed at an appropriate spatial scale and which helps ensure that decision makers have incentives to take the social costs of their actions into account.

There is evidence to suggest that in some countries decentralised urban water services have the advantages of allowing more demand responsive provision, greater accountability, and technical flexibility without significant losses of economies of scale and scope. However, such decentralized systems have to operate within a strong strategic and regulatory framework. Moreover, institutions to promote coordination and cooperation between sectoral actors and across jurisdictional boundaries will need to be put in place. In developing the strategic framework within which different sectoral and spatial actors operate it is important to consider the policy tools available at different levels of government and governance. Furthermore an instrument (or policy mix) will need to be developed, not only to meet different policy goals, but also to ensure that local or sectoral actors do not operate in narrowly self interested ways.

There are relatively few urban management tools which are automatically compatible with the efficiency, equity and environmental sustainability objectives of IWRM. Implementation practice is crucial.

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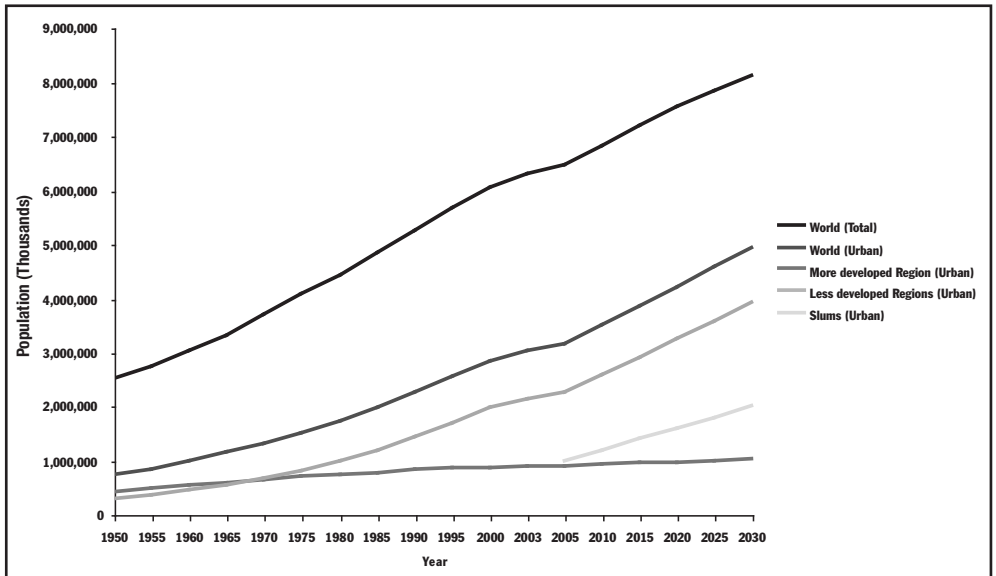
1. THE URBAN WATER CHALLENGE

We are living in an increasingly urbanised world. At the present time approximately 50% of the world's population inhabit urban areas, whereas 35 years ago the urbanised population represented only 37% of the total. By 2025 it is expected that an extra 2 billion people will have been added to the urban population, bringing it to 5 billion or over 60% of the total (see Figure 1) (Meinzen-Dick and Appasamy, 2003). Crucially, 95% of this increase is likely to occur in the developing countries and a significant proportion will end up living in urban slums. According to Tipping, Adom and Tibaijuka (2005), the slum population today is approximately 1 billion, which is expected to grow to 2 billion by 2030 and 3 billion by 2050. This "growth is taking place without the corresponding ability of many cities in the developing world to expand public provision of basic services" (p.23). Consequently "we are witnessing the continued and rapid urbanisation of poverty and ill health" (p.22).



Source: World Urbanization Prospects: The 2003 Revision Population Database, United Nations, 2004 esa.un.org/unup/p2kodata.asp

Figure 1: Urban Population Growth

The pace of urbanisation clearly represents a major challenge for those responsible for the provision of the basic water and sanitation services so vital for the health, dignity and economic wellbeing of the urban population. Moreover, urbanisation on this scale also has critical physical and socio-eco-

nomic impacts which extend far beyond the built-up areas of the city. It creates, for example, challenging problems for the management of the increased competition between the urban sector and other water users for affordable raw water supplies, for the protection of the water resource from contamination by domestic wastes and industrial effluents, for the containment of the environmental and health damage created by urban concentration and for the mitigation of increased flood risks arising from changed run-off regimes. In other words, urban water management involves duties and responsibilities which transcend the jurisdictional boundaries of the urban area and the functional boundaries of water utilities.

Furthermore, given the sheer size of many urban populations, their political importance and the role of major cities as growth engines for the economy as a whole, urban services management poses critical questions for all those policy makers and managers concerned with sustainable development in the national economy and with the allocation of scarce physical, social and financial capital.

It has been clearly recognised that there are crucial interdependencies between water and sanitation provision and the achievement of many of the Millennium Development Goals and Targets established at the United Nations Millennium Summit in September 2000 (UN Millennium Project Task Force on Water and Sanitation, 2005). Likewise, it has been argued that "clean water and adequate sanitation would be humanity's best investment to achieve development and sustainability" (Tipping, Adom and Tibaijuka, 2005, p.13). Reducing the enormous health, economic and environmental costs associated with inadequate water services provision would release valuable economic and social capital needed for sustainable development (Rijsberman, 2004, Hutton and Haller, 2004, UN Habitat, 2003)

The interdependencies between water, health, well being and economic growth make it clear that water services policy and practices should not be viewed in isolation but seen as an integral part of social and economic development and the creation of liveable, sustainable cities. This will require an intersectoral, co-operative approach to planning and management across the urbanised area. Such an approach is also necessary because urban water service problems are not the result of some inherent properties of the services but are products of urban governance, the availability of human and economic

capital and the politics governing resource allocations between sectors and social groups. In other words water problems will not be solved by sector professionals acting alone but will need to involve those with the power and authority to manage urban development, those responsible for priority setting and resource allocations at both the national and local scales, and those charged with mitigating the unwelcome consequences of urban growth.

City size and the diversity of socio-economic conditions amongst urban dwellers also raise critical issues about managerial scale, appropriate service providers and provision practices. Do the physical interdependencies inherent in urban areas and the potential economies of scale and scope necessitate that cities are managed as single entities or can decentralised systems play a role in urban water and sanitation? Decentralised, people centred management could allow market segmentation, with levels of service and provision technologies geared to the differential financial and technical capacities of the various social groups within the city. However, if decentralised systems exist (whether created by design or by the expansion of the built-up area to encompass several local authority jurisdictions) then appropriate cooperative or regulatory mechanisms need to be in place. These would aim to ensure adequate baseline provision standards, avoid the transfer of external costs (e.g. through pollution, health or flood damage) to other parts of the city and where possible to capture economies of scope and scale.

Intra-urban integration, cooperation and regulation are necessary but not sufficient conditions for the promotion of more sustainable approaches to development. It is also now widely accepted that water and sanitation cannot be considered separately from the management and protection of the water resources base or from environmental services more generally. Neither can the urban sector be divorced from the rural. Urban services management has to take account of the socio-economic interdependencies that affect both the effective supply of raw water and the demands placed upon the resource. If there are to be more sustainable, socially sensitive and economically efficient water management practices then there needs to be a more integrated approach to the management of water within the wider interdependent physical and social systems. Major urban centres are critical components of such systems and could have a lead role to play in promoting governance and practice change.

2. INTEGRATED WATER RESOURCES MANAGEMENT

There is now a considerable literature on Integrated Water Resources Management and its role in the promotion of more sustainable approaches to water development and management. The potential for IWRM to help overcome the problems and inefficiencies inherent in uncoordinated, sector-dominated and competitive water management approaches was clearly recognised at the World Summit on Sustainable Development (WSSD) in 2002. All countries were called upon to develop IWRM and water efficiency plans by 2005 which *inter alia* should:

- Employ the full range of policy instruments to improve the efficient use of water resources and promote their allocation among competing uses in ways that give priority to basic human needs and balances human development requirements with the need to preserve or restore ecosystems and their functions.
- Include actions at all levels and adopt an integrated water basin approach.
- Support the diffusion of technology and capacity building for non-conventional water resources development and conservation approaches.
- Facilitate the establishment of partnerships, the involvement of all concerned stakeholders and, while respecting local conditions, provide stable and transparent regulatory frameworks, monitoring systems and measures to improve public accountability.
  (Article 26 WSSD Plan of Implementation, September 2002)

As Tipping, Adom and Tibaijuka (2005) have acknowledged, "the 2005 IWRM target offers the potential to implement the management and policy framework essential for successful achievement of water and sanitation targets" (p.13). Likewise the UN Millennium Project Task Force on Water and Sanitation (2005) recognises the role that IWRM could play in meeting "all the Millennium Development Goals, not only the one dealing specifically with water supply and sanitation" (p.37).

However, rather surprisingly, given the importance of the urban sector to the social and economic development of most countries, little appears in the IWRM literature which explicitly considers what an IWRM approach might involve for urban centres. Moreover, few city managers or politicians have engaged with IWRM. The potential benefits of employing the IWRM concept at the intra-urban scale are at best poorly understood. IWRM is typically seen

as something to do with river basins and of limited relevance as long as the city continues to be able to successfully compete to secure additional sources of water. As Molle and Berkoff (cited in Van Rooizen et al., 2005) point out cities have been very effective in capturing water from agriculture using a variety of formal and informal mechanisms, such success reduces the apparent need for urban administrations to become key actors in the IWRM process.

Work on IWRM does, of course, refer to urban situations and many of the instruments that are of potential value when adopting an IWRM approach have been exemplified in an urban context. For example, there is now a wealth of material on urban demand management, pollution abatement tools, leakage control, dual supply and recycling, decentralisation and public-private partnerships. However, much of this material is instrument specific and does not explore the broader dimensions of IWRM in the urban context. Furthermore, little attention has been focused on what specific problems could arise in attempts to implement an IWRM approach in major metropolitan centres, although there are some potentially relevant lessons to be learnt from efforts to employ participatory and co-operative approaches to the solution of other urban problems. One potentially valuable set of experiences can be found in the work on sustainable cities and efforts to implement Agenda 21, a key output from the 1992 UN Conference on Environment and Development (United Nations, 1992). Agenda 21 recognises the vital role of local governments in addressing the many environmental problems encountered in developing world cities, including water-borne pollution, sanitation and vulnerability to water-related hazards.

Just as the IWRM literature has tended to neglect the urban dimension, so the now voluminous literature on urban water and sanitation provision has been largely silent on the broad role of IWRM. There are, of course, exceptions to this general statement, most obviously in countries, such as South Africa and Singapore where IWRM principles are being incorporated into the strategic planning and management of urban water services (DWAF, 2004; www.pub.gov.sg). The urban water services literature does make reference to specific management instruments, such as demand management tools, stakeholder participation and community actions, which are potentially consistent with an IWRM approach but typically it does not consider the range of cross-sectoral actions and assessments which would be involved in the implementation of an IWRM process. For example, in the UN Habitat report on Water and Sanitation in the World's Cities, which sees improving urban services provision as part of IWRM, the discussion focuses almost exclusively on specific demand management instruments. "The aspect of IWRM with the most immediate relevance to urban water and sanita-

tion management, however, is demand-side management (DSM)" (UN Habitat, 2003, p.193). Although DSM techniques are undoubtedly of importance and the report very usefully highlights the lessons and potential tensions arising from implementation attempts, the focus on DSM gives only a partial view of the role of IWRM in urban water management. It neglects both the interrelationships between water and other urban services and the role of the urban in the efficient and sustainable development of scarce natural and human capital resources.

3. THE REMIT AND STRUCTURE OF THE PAPER

In this paper an attempt will be made to consider IWRM approaches to urban water management in a broader way. While appropriate management tools will be considered, attention will be focussed on institutional design, decision-making scale, governance and the critical question of implementation practice. For reasons already cited the remit of the paper must go beyond the physical boundaries of urbanised space to recognise both the resource pull exerted by cities and intersectoral competition for such resources and the two-way flow of negative externalities or opportunity costs between urban water services and other parts of the national economy, society and environment. It is, of course, recognised that the word urban covers a huge diversity of conditions; although the same IWRM principles are likely to be relevant in all urban centres, the complexity and difficulties involved in implementation will vary markedly with, for instance, city scale, income levels and human capital endowments.

An IWRM approach is not a single entity with set measures that can be implemented in all socio-economic conditions and at all levels of governance. Critically the appropriate institutions and tools will vary with the scale of the analysis and the paper will attempt to consider such variations on a scale continuum from the household/community level to national government. It will not explicitly address the transnational scale, although it is clear that the impact of urban growth on trans-boundary waters and shared coastal fisheries would require cross-national institutions and actions. Furthermore, it is recognised that there are arguments for regarding water and sanitation as global public goods (perhaps most obviously through the transnational transmission of water-related infectious disease) which need international co-operative action (Smith et al., 2003, Tipping, Adom and Tibaijuka, 2005).

Attention will be paid first to the need for an IWRM approach and the dimensions of such an approach. The need has to be considered not only in terms of the escalating demands placed on urban water, sanitation and drainage services themselves, but also must recognise the role of the urban sector in meeting national economic development, poverty reduction, health and environmental policy goals. The question of decision-making scale will then be addressed, with consideration given to the potential tensions between the scales best suited to meet such different policy objectives as operating efficiency, the efficient allocation of resources, people centred provision, customer and environmental protection. There will be discussion both of the potential advantages of unbundled operational functions and the need for any such unbundled systems to work within a clear strategic and regulatory framework. The paper will then consider the institutions which could be employed within an IWRM process to promote co-operation and coordination between the diversity of actors with some impact on urban service delivery. Attention will then turn to the policy instruments available at different governance scales, looking at the instrument mix and the implementation practices needed to meet different public policy goals and IWRM objectives.

4. THE NEED FOR AND DIMENSIONS OF IWRM

IWRM is not an objective in its own right but a means to increase the benefits derived not only from the scarce water resource itself but also from the equally scarce financial and human capital resources needed to convert the resource into usable products and services. As defined by The Global Water Partnership, IWRM is a process that "promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP TEC, 2000). IWRM is not an instant magic bullet, a general panacea, for all water problems. Rather it is a problem solving approach which explicitly recognises the complexity and multi-faceted nature of water problems, the diversity of stakeholder and disciplinary perspectives and the implications of human and physical system interdependencies (Lenton, 2006).

There are four broad reasons why IWRM approaches are now essential:

- The negative externalities that arise from the uncoordinated use of the physically interdependent water and land resources.

- The opportunity costs which arise when factors of production (including water, land and capital) are employed for low value/benefit purposes.
- The negative externalities and opportunity costs which arise from the uncoordinated provision (non-provision) of interdependent basic services such as health, education and sanitation.
- The cost savings which can occur by widening the range of provision or management options.

None of these broad reasons are exclusive to urban water problems, nor could they be given the relationships between the urban, the economy, society and the environment. When discussed in an urban context, however, they raise specific institutional and governance questions which tend to be lost when attention is focused on the water resource at an integrated basin level.

Although the language used in framing the reasons why an IWRM approach is needed is economic, it has to be clearly recognised that the costs and benefits have to be evaluated in terms of the social, environmental, political and economic objectives of different countries.

(a) Physical interdependencies and negative externalities

Policy makers and managers have to work with the fact that water is a hydrologically interconnected resource. All human activities within a catchment will have impacts elsewhere in the water system:

- Deforestation and urbanisation will change run off regimes affecting both the timing of usable water flows and the risk of flood events or landslide hazard events.
- The quantity, timing and location of water abstraction from both surface and ground water will clearly impact potential downstream users.
- Land use changes can alter evapotranspiration rates, return and sediment flows and the timing of abstraction, all of which can affect supply availability and the costs of water service provision.
- The waste products in return flows from agriculture, industry and households will affect downstream and ground water quality, imposing direct costs (the need for greater water treatment or reduced crop yields) and opportunity costs by restricting the range of subsequent economic, environmental and recreational uses.

While the level of human activity in a catchment remains low and water resources are plentiful in relation to the demands placed upon it, such impacts may be negligible and the transaction costs involved in attempting to

manage the impacts may far outweigh the resultant benefits. However, there are very few parts of the world where such favourable conditions now exist and they certainly cannot occur where large-scale urban development has taken place within catchments.

The negative externalities imposed on all downstream users and coastal waters by large-scale urban abstraction and by contaminated return flows are well known and well documented (Agarwal, Narain and Sen, 1999; Showers, 2002; UN Habitat, 2003, Chapter 4). Likewise the effects of urban 'concretisation' and storm water drainage systems on the magnitude and frequency of downstream flooding and on the rates of aquifer recharge have been clearly recognised. Negative externalities also arise from urban encroachment on to rural land as productive agricultural areas are lost and urban pollution or siltation from land clearance affects irrigation and drainage channels. In Egypt, for instance, a country desperately short of cultivatable land, it has been estimated that 10% of the most productive land was lost to uncontrolled urban growth in the three decades from 1950 (Hardoy, Mitlin and Satterthwaite, 1999). Major external costs can also be imposed more indirectly throughout the extensive urban footprint as developments take place to meet demands for food, forest products, energy and a whole range of other raw materials.

External costs associated with the neglect of hydrological interdependence and land-water linkages are not just transferred to others outside the urban area but also are imposed on the cities themselves. Municipal water providers can curb costs in the short term by overpumping local aquifers but if this results in saline intrusion and the percolation of contaminants into the ground water then costs are passed on to future urban users as costly distant sources have to be tapped. This is exactly what happened in Dakar (Senegal) where a substantial amount of the city's water needs has now to be transported 200 kilometres from Lac de Guirs due to the pollution of and salt water intrusion into overpumped local aquifers (UN Habitat, 2003, p.135). Overpumping of ground water can also impose costs on other urban sectors if subsidence occurs, damaging buildings, infrastructure and exacerbating flood problems. Mexico City affords a well known example of such a situation. The central area has subsided by some 7.5 metres over the last 100 years, weakening buildings and infrastructure and adding considerably to the costs of flood control and drainage. Dykes have had to be built to confine storm water flows and pumped drainage has had to be provided (UN Habitat, 2003, p.141).

The lack of effective land use planning and development controls or the failure to recognise land-water linkages in the development process can also impose significant costs. Uncontrolled growth has a direct impact on the cost of water and sanitation provision if the new developments are far from or difficult to connect to (e.g. are at much higher elevations) existing networks. Even more crucially, there are numerous cases where cities are literally soiling their own nests by failing to protect vital water resources from all forms of urban pollution, from industry, housing developments with inadequate or non-existent waste water systems and from solid waste. Just to give one example, the problems posed for drinking water quality in New Delhi (India) by the uncontrolled encroachment of settlements along the banks of the Yamuna River are currently before the Supreme Court. Despite court rulings over the past decade encroachments have not been halted by the city authorities and water quality is progressively deteriorating; according to the Supreme Court Bench it will be necessary to remove some 50,000 encroachments on the river banks if India's capital city is to be provided with water of drinking water standard. The costs of tackling this water quality problem will not be trivial, either alternative accommodation will have to be found for the population living along the banks or sewage treatments plants constructed wherever drainage from the settlements flows into the river; moreover, for river quality to be subsequently maintained strict controls over further encroachments will need to be in place (Venkatesan, 2006).

Further costs from the lack of effective planning and development control arise when the haphazard intermingling of industrial and domestic properties not only increases health risks from water-borne effluents but also curtails opportunities for the safe and economic re-use of waste waters. Similarly externality costs occur when building (often squatter settlements) occurs on flood prone areas, on unstable hillsides and on watersheds within local catchments. As the Kuala Lumpur case study illustrates (Box 1) failure to control settlement in the drainage basin and to make adequate provision for foul and surface water drainage in such settlements has greatly exacerbated the flood hazard problem in the commercial centre of the city. The capital cost of rectifying such problems retrospectively can be enormous and clearly impose foregone opportunity losses on the economy as a whole.

Urban centres are not just the generators of cost but also suffer from external costs imposed by upstream users. Water shortages in Beijing, for example, have partially arisen because of land-use patterns and industrial pollution in upstream Hebei province (UN Habitat, 2003). Other cities are faced with

Box 1: Kuala Lumpur Storm Management and Road Tunnel Project (SMART)

Kuala Lumpur, the capital of Malaysia, is prone to flash flooding during periods of localised, high intensity rainfall; small scale incidents can occur several times a year. However, the magnitude and frequency of serious incidents has increased markedly over time; in just a few years, between April 2000 and June 2003, the city centre was inundated five times, causing major economic losses and seriously disrupting commercial activity. It is widely acknowledged that such incidents are directly attributable to inadequately planned and controlled urbanization.

Development in local catchments has markedly increased run-off rates; investment in appropriate holding and drainage infrastructure has failed to keep pace with the urbanization process; indiscriminate land clearance has led to the siltation of existing drainage channels and holding basins; housing, infrastructural and commercial developments have encroached onto flood plains, natural drainage channels and flood storage areas.

Currently a major project is under construction to alleviate the flood problem. It involves the construction of a waste diversion tunnel some 9.7 km long (and costing in excess of RM2 billion) to carry flood waters around the city centre and several storm water holding basins and control structures, needed in part to ensure that the flooding problems were not simply transferred to downstream locations. An innovative aspect of the project, justifying its SMART acronym, is that part of the diversion tunnel will also be used to alleviate traffic congestion. A double-decked motorway will be constructed in the tunnel, above a drainage channel capable of handling minor floods. During more major events the motorways will be closed and the tunnel used solely as a diversion conduit. Such dual use undoubtedly makes the project more cost-effective but its cost and technical sophistication are still considerable.

additional flood defence costs or flood damage losses as a result of changed run-off regimes, while others incur extra treatment costs to remove agricultural residues from water supplies. Urban growth itself is likely to increase these costs as the demand for food and fibre encourages agricultural intensification and land use change.

In planning for water resources development and use, the negative externality flows need to be evaluated. The aim of such an evaluation is not to stop all impacts which impose costs elsewhere in human and environmental systems; such an aim would not be efficient and would stultify economic and social development. Rather there is a need to ensure that a balance is achieved between the full social costs (i.e. private costs plus negative externalities) of a water-related activity and the benefits derived from that activity. An IWRM approach would seek to ensure that individual decision makers, be they farmers, local government officials, utility managers or sectoral ministers, have incentives to make investment and water use choices based on social cost-benefit assessments and not on the basis of private or sectoral interests. Moreover, such assessments need to be made over socially or environmentally relevant timescales to ensure that developments are sustainable and any incentive structures put in place have to be flexible enough to cope with changing socio-economic and environmental circumstances.

(b) Human system interdependencies, inter-sectoral competition and opportunity costs

IWRM has been translated by some into river basin or catchment management, where the focus is on managing the physical resource. From such a viewpoint a key IWRM dimension relevant for urban water management would be the appropriate allocation of scarce resource supply and waste absorptive capacity between municipal users and competitor water sectors, including the environment. This is a particularly pertinent issue where river basins are 'closed' and all currently available water is committed, any new developments require supply reallocation, usually from agriculture to urban purposes.

If the key issue is how to improve water resources management within a water basin to allow future urban needs to be met, the solution may appear conceptually and economically simple, the reallocation of supplies from agricultural to urban use (Rogers, 1997; Rogers, Bouhia and Kalbermatten, 2000). The basic argument for such reallocation is that the marginal value in use of water taken by the agricultural sector is very low relative to that used for domestic,

industrial and commercial purposes. This is particularly so when, as is commonly the case, irrigation water is provided at zero or highly subsidised rates and farmers have little incentive either to irrigate using water efficient technologies or to curb the production of water intensive, low value crops. Transfers from agriculture would help optimise the value in use of the water resource as a whole and could be achieved using market tools (pricing or tradable rights) or by fiat and regulation.

It is also argued that such transfers need have a minimal impact on agricultural sector outputs. Projected urban needs are relatively small (only 4.4% of the current agricultural consumption in developing countries would cover all urban demands up to 2020 (Rogers, 1997) and there is enormous scope to improve agricultural water use efficiency. Additionally, as Van Rooizen et al. (2005) have pointed out cities can act as water providers for the rural sector. First, as relatively little urban water is consumed by use, waste water flows could be utilized and second, advantage could be taken of the additional storm water run-off generated by impervious urban land surfaces. Where the use of such sources is planned their contribution can be considerable; Bhari (2000) for example, cites the case of Tunisia where it is expected that reclaimed waste water will make a contribution to supplies equal to approximately 10% of the available ground water. However, when the use of waste water and storm water flows occur in an unplanned manner, as is already widespread in many low income countries, questions arise over the potential environmental and health impacts (Scott et al., 2004; IWMI, 2006).

While the economic efficiency case for water transfers may be compelling, in practice there are significant political, social and institutional problems associated with transfers (Meinzen-Dick and Appasamy, 2003). An IWRM approach would need to recognise these problems and include evaluation of the investments needed in the rural sector to improve agricultural productivity, maintain vital food production and mitigate the social consequences of transfers. Furthermore, it has to be noted that reallocation by itself will not necessary mean that desired public policy objectives are met. As was pointed out in UN Habitat (2003), there is no guarantee that the water released from agriculture will in itself result in improved "access to water or sanitation among currently deprived residents, or result in the sort of health improvements that better water and sanitation provision allows" (p.193).

Water supply reallocation is clearly an important issue for IWRM but human system interdependencies raise others of importance. Such interdependencies

allow direct costs and opportunity costs (losses from foregone opportunities) to be transferred from one functional, spatial or social sector within an economy to another. Urban water management decisions can clearly transfer costs or losses to the health, fisheries, industrial or services sectors. Urban planning decisions or non-decisions can fail to protect the water resources base from overexploitation and pollution so transferring costs or denying clean water to all users and uses (DWAF, 2004). Likewise, decisions on food or energy security, export-led industrial growth, land-use zoning or tourism development will critically affect the demands placed on the water resource base and on water service providers.

Some of these cost transfers may be desirable if they allow national, regional or local priorities to be met, but in many cases they are the unintended consequences of poorly informed, misguided, self-interested or even corrupt decision making. The result is that scarce resources (physical, economic and social) are squandered and socio-economic development is impeded. Robins and Kumar (1999) and Appasamy (2000) give a local scale example from the town of Tiruppar, South India, which expanded rapidly in the 1990s with the growth of the hosiery industry, following the opening up of export markets. Pollution of river and ground water from untreated effluents has imposed major losses on local irrigators and fisheries and on the municipal community as more distant and costly water sources have to be tapped. In other words industry shifted part of its costs on to others. However, in the longer term it also squandered some of its own investment resources as in May 1998 the Supreme Court ordered the closure of 460 plants for failing to comply with pollution control regulations. Other plants had to construct add-on treatment facilities. Such retrofit systems were inevitably more expensive than waste control measures undertaken during plant construction and yet some still fail to meet the required quality standards.

The fact of human system interdependence does not imply that IWRM requires a vast central planning bureaucracy where inevitably doomed attempts are made to coordinate everything. Rather it means that mechanisms and institutions are needed which, first, can identify the cost/loss transfers, second, help ensure that any transfers are intended and consistent with economic or social policy objectives and third, provide fora where compensation for loss decisions can be made (compensation may be direct payments, sector budget adjustments or investments in alternative livelihood opportunities).

A final dimension of IWRM that arises from human interdependencies and inter-sectoral competition concerns the scarcity of capital, both financial and human. In many countries financial capital, not water, is the critically scarce resource and in an urban context this could be the norm given that a high proportion of water used could be recycled, albeit at a cost. Competition for capital will inevitably increase as it is known that the long-run marginal costs of supply provision has risen markedly over time (World Development Report, 1992) and will continue to do so as cities grow, so needing to tap ever more remote sources and/or employ more costly treatment technologies to cope with saline or polluted sources.

Competition for capital obviously exists both within the water sector and between water and all other sectors of the economy. National governments have traditionally given a much lower priority to investments in water and sanitation than they have to transport, energy, telecommunications or weapons (Serageldin,1994) and have often seen water service financing as a devolved local government matter. International agencies have historically devoted only a small proportion of their budgets to urban water and sanitation (Hardoy, Mitlin and Satterthwaite, 2001). Private financing of water infrastructure projects has likewise been relatively small, representing approximately 5.4% of the overall value of private infrastructural investments between 1990–2002 (OECD 2004) and since 1997 this financial flow has withered to insignificant proportions. Local governments, who in most countries have functional responsibility for water and sanitation provision, all too frequently have lacked the rate base or borrowing power to ensure that investments kept pace with urban growth, failed to ensure that service operators generate enough revenue to cover costs and are performing at levels which would make them credit worthy (Gurria, 2006) and have not placed the water services high on their investment priorities.

While the water sector as a whole suffers from capital investment scarcity, funding for sanitation has been particularly problematic. According to data from the Joint Monitoring Programme for Water Supply and Sanitation (WHO and UNICEF, 2000 and 2004) only one fifth of the total investment made across the developing world in the two services from 1999–2000 was directed towards sanitation, while in Asia the proportion dropped to one sixth. Not surprisingly the world is not on track to meeting the MGD of reducing by half the proportion of people without access to basic sanitation by 2015. It is estimated that to meet the target an additional 1 billion urban dwellers will need to be provided with sanitation services, but given urban growth this would still leave another 1 billion unserved.

An IWRM approach would need to address the priority afforded to urban water and sanitation investments, recognising, of course, that it might be economically rational for governments to give such investments low priority if the real social rate of return is below that available elsewhere in the economy. Low rates of return on urban water projects have indeed apparently been commonplace. In part such seemingly low returns reflect poor utility performance and the commonplace failure to set prices at levels which even recoup operating and maintenance costs. However, they also arise because of the narrow focus of many project appraisals. Typically these concentrate on the returns made by the utility and neglect the fact that most benefits will not flow back into the water sector, but will come through as health, welfare or productivity improvements, time-saving and higher academic achievement (Hutton and Haller, 2004). If the investment priorities of governments are to be changed it is vital that water's wider role in social and economic development is incorporated into investment appraisals. Hutton and Haller's work for the WHO found that when the cross-sectoral benefits from investments in water and sanitation were evaluated then very positive net benefits, typically between $5–$11 per $1 invested, were achievable. Further such studies at national, city and community levels could play an important role in priority shifting. However, neither economic appraisals nor participatory priority setting exercises will have any impact on decision-making unless institutions exist to allow cross-sectoral choices to be made. Such institutions have to be established to reflect the boundaries of human management systems, which are unlikely to bear much relationship to hydrological divisions.

IWRM strategies for urban water supply would also need to consider both the barriers to increasing the financial flows from all sources into the sector and mechanisms to improve the efficiency and effectiveness of new and existing capital assets in meeting urban water demands on a sustainable basis. Maintenance neglect, tariffs set below provision costs, poor revenue collection, technologies unsuited to local socio-economic conditions are all well known examples of managerial failures which would need to be addressed during the IWRM and efficiency plan implementation process. Likewise in the case of sanitation IWRM strategies will need to consider low cost technologies appropriate for local socio-economic and environmental conditions and where public sewerage services are provided the question of cost-recovery will need to be addressed. According to Wright (2005) Jakarta may be one of only four cities in the East Asian and Pacific Region where the average tariff exceeds the average operation and maintenance costs, so providing a contribution (albeit small) to the capital costs. In Indonesia, despite the fact that sewerage costs

up to three times more than water supply infrastructure, tariffs have usually taken the form of a modest surcharge on the water rate. The Indonesian situation is by no means atypical of other developing countries and clearly such tariffs represent a massive subsidy paid out of scarce city resources to a small (usually the most wealthy) section of the urban community.

Human capital scarcity is a further important consideration and an IWRM approach would need to assess whether investments in improving managerial, collaborative and regulatory capacities would yield greater returns than investments in the development of the water resources per se. Further, it would need to address the constraints imposed by human capacity scarcity on the effectiveness of a whole range of policy measures designed to improve urban provision. For example, decentralisation and community participation may yield few benefits without investments in skills and information transfer.

(c) Interdependent basic services provision

The externality losses and opportunity costs arising from the uncoordinated provision of basic urban services raise no new issues of principle from those already discussed in the previous sections on physical and human system interdependencies. However, in terms of the planning, management and governance of urban services it is important to recognise the inter-linkages which exist between many of them. Such linkages may have four broad effects:

1. Economies of scope may exist through the joint operation of services or components of such services (e.g. cost savings through joint billing for water, sewerage and electricity) or economies of scale may be achieved if several community groups or local authorities cooperate to provide a specialist service, such as sanitation and health education in schools, or enter pooling fund arrangements to attract capital flows into projects (Gurria, 2006).

2. The sustainable benefits derived from a project or service may be restricted by the failure to provide another service (e.g. the benefits from water and sanitation projects have been found to be enhanced by hygiene promotion/education [Wright, 2005]).

3. The costs of providing one service can escalate through the failure to deliver another related service (e.g. health service costs increase markedly from failure to provide adequate water, sanitation and drainage facilities).

4. The technologies and service quality standards deemed appropriate for one service may increase the costs of and reduce the technological and resource recovery options available to the other service providers (e.g. increased water provision can change the feasible options for excreta disposal while the construction of combined storm and waste water drainage systems can vastly increase the cost of sewage treatment plants).

Interdependencies between basic services raise complex administrative questions, particularly in large metropolitan centres with fragmented jurisdictions. Some mechanisms for integration will be needed both to work across such jurisdictions and between the administrations for each separate service (e.g. water supply, sanitation, health, education, land development, environmental protection and drainage). What is important for the efficient and effective use of scarce natural and human capital is that stand alone provision of any service should reflect inter-service linkages and be informed by a sound understanding of the cost benefit implications of decisions. However, it has to be recognised that integration, co-operation and coordination involve transactions costs which also need to be taken into account.

(d) Widening the range of provision or management options

For well over 60 years, the resource management literature has shown that managers rarely evaluate the complete set of options for solving a specific problem. Rather, they consider a much reduced 'perceived' range determined by the jurisdictional boundaries (spatial and functional) of agencies, their professional training and the 'norms' of professional practice, and the solution options employed in the past. An IWRM approach to urban water services would seek to ensure that consultative and coordination mechanisms were in place to identify a wider range of provision or management options and select the most cost-effective or most welfare beneficial method of problem solution or problem avoidance. In considering the option range it is important to look at the way the problem is framed. For example, if the problem is viewed as insufficient supply capacity to meet growing urban requirements this could produce a more narrowly technical set of options than a problem frame which focussed on providing appropriate levels of service to the diverse and increasing urban population.

Clearly, option ranges are problem specific and operate at different spatial scales – national, basin-wide and local – and in some cases institutions for cooperation will be needed at more than one scale. For example, if we take the urban flood mitigation case where the management option range has been well

explored (White, 1942; May et al., 1996), then linkages across city governance will be necessary to evaluate levee drainage or overflow channel construction, land use and flood plain occupancy controls, building regulations, warning systems or post flood relief measures. However, mechanisms will also be needed at a broader scale to allow consideration of upstream structural solutions (perhaps through multi-purpose dam construction), non-structural land use controls, the creation of flood spillage areas (where flood losses would be minor compared with the costs which would be imposed in the city) or the instigation of reforestation projects to decrease run-off and sedimentation (see for example GWP, IWRM ToolBox, Case 100).

Similarly, if the problem focus is switched to urban supply scarcity, then the solution option range can be significantly increased if the urban utility has some low transaction cost means to influence upstream activities. There are a few cases in Ecuador (UN Habitat, 2003, p.252) and in Costa Rica (GWP, IWRM ToolBox, Case1) for example, where watershed/forestry management, part funded from urban water charges, has been seen as a partial alternative to supply fix solutions but those examples are still rare. Further supply options could also arise if the new water cycle created by urbanisation is viewed as an entity. Waste water could become a supply asset rather than a pollution problem and, importantly for countries with very variable rainfall, waste water provides a relatively constant supply throughout the year. Likewise, the increased run-off from urban surfaces could be harnessed for both urban purposes, as it is in Singapore, and in adjacent agricultural areas. Clearly water recycling and the use of surface water run-off have to be planned, investments made, health protection measures introduced and any public fears about use addressed but the potential for water reuse is now increasing recognised (see Box 2).

At the city level the way that urban development is managed in terms of, for example, layout, density, building design and zoning can have very significant implications for water service delivery and the costs involved. Options to manage demands, protect existing water sources or seize reuse opportunities may be restricted if land planning, building or appliance regulation, school curricula, industrial development and pollution abatement, and ground water abstraction control remain uninfluenced by service providers. It has to be noted that reduced solution option ranges can also occur in other sectors if managers do not see the water sector as having a role; this most obviously applies to health where adequate water supply and sanitation may be more cost-effective than the provision of additional health care.

Box 2: Water Reclamation and Reuse Options

Traditionally, water has been used on a once through and discharge basis. Although planned reuse began in the early 20th century, it is only in the last 30 or so years that its potential has been widely recognised. Unplanned reuse has, of course, been a fact of life for many centuries. Planned reuse can occur at various scales, from the individual household to the large scale river basin.

Individual Property Scale

At household level storage tanks can be used to collect water from baths and sinks for subsequent use in toilets or for garden watering. Such conservation measures may be required by statute, attached as a condition to development consents or may arise through the incentive effects of high water and wastewater charges. In sewered areas reuse levels need to be compatible with the flows necessary to maintain foul water removal, but in house recycling can operate well in conjunction with non-piped forms of sanitation.

In plant industrial water reclamation and reuse is now widely employed in developed countries both to reduce water supply costs and, more recently, to meet increasingly stringent discharge regulations and curb escalating effluent charges. Closed loop recycling systems (water is reused for the same process) or sequential use schemes (water is employed for progressively less quality sensitive purposes) clearly require investments, which are much less costly if they are made during plant construction or re-engineering. Industry will only make such investments if governments have effective incentive structures and regulatory systems in place.

Urban Scale

By far the most common form of planned reuse is the use of minimally treated (enough to safeguard public health) reclaimed water for a whole range of non-potable purposes – in industrial processes, for toilet flushing, street cleaning and the watering of urban parks, landscaped areas, recreational spaces (such as football pitches or golf courses) and gardens. This not only saves water but can also reduce water supply treatment costs by cutting the use of expensively treated potable water for purposes not requiring that level of purity. However, clearly costs are incurred in developing a separate reticulation system and in ensuring effective controls over industrial pollutants not compatible with reuse. Such costs can be significantly reduced if the potential for reuse becomes an element in urban design, land use zoning, development control and building regulations; for this to happen cooperative relationships would be needed between the water service providers, local planning and development control authorities, and other key stakeholder groups.

In some cities another important use for reclaimed water is aquifer recharge. Where the aquifer is not a drinking water source, the recharged water can be a valued additional resource for industry, irrigation of low health risk crops and watering recreational and amenity land areas. Importantly, it can also act to reduce subsidence and salt water intrusion. Recharge can also contribute to potable supplies but clearly measures to safeguard public health would need to be in place.

Planned reuse for potable purposes is still rare but improved technologies are likely to make this a more widely considered option in water shortage areas as long as the issue of public acceptability can be addressed. Windhoek in Namibia was the first (1968), and is still the only, city to employ direct, or pipe to pipe, reuse; treated waste water is mixed with fresh water on a 25/75% basis and is then fed back directly into the water distribution network. Elsewhere there are cases of indirect planned reuse where reclaimed water is fed into reservoirs or other water bodies before being abstracted, treated and used in the potable supply system. In 1978, for instance, a scheme was commissioned at the Upper Occoquan Sewage Authority plant in North Virginia, which reclaimed waste water for return to a water supply reservoir. More recently, Singapore's NEW water scheme, while primarily providing reclaimed water for industrial processes and air-conditioning, also contributes to potable supplies; reclaimed water is pumped into supply reservoirs for mixing and blending with raw water before being treated again to drinking water quality standards.

Basin/sub basin scale

Reuse at this scale is commonplace; inevitably downstream river water users will be taking supplies which contain waste waters from up stream sources. Much of this reuse may be classed as unplanned but in developed countries it normally occurs within a regulated system, with controls over upstream effluent and sewage treatment standards. There are cases where river water quality is improved after the addition of highly treated waste water and this situation is likely to occur more often as the regulations governing sewage treatment plant processes and discharge standards become increasingly stringent.

Regulated reuse can be seen as a vital element of IWRM, ensuring that available resources are used and reused for productive and environmental purposes, while keeping health and environmental risks to an acceptable level. Acceptability is a context specific concept and countries will need to adopt reuse guidelines which reflect their economic, environmental and social circumstances.

Sources: Asano, 2006; IWMI, 2006; Law, 2003; www.pub.gov.sg

5. DECISION MAKING SCALE – POTENTIAL CONTRADICTIONS

Inevitably, given the interdependency relationships discussed above, an IWRM approach to urban water services will involve decision-making at very different spatial scales; national or regional decisions on macro-economic policy priorities and resource allocations; urban-rural interface decisions to distribute resources and curb undesirable externalities; intra-urban decisions to promote co-ordinated, efficient and sustainable service delivery. In this section the focus will be on the question of whether there are potential contradictions between the decision making scale needed to meet three different goals, all of which are part of an IWRM approach, namely:

1. Operating efficiency and the achievement of economies of scale and scope in urban services provision.
2. Transparent, independent (or acceptable) performance monitoring and regulation.
3. Meaningful stakeholder and public participation to help ensure the provision of appropriate levels of service to different social/income groups.

One of the basic tenets of an IWRM approach is that water decisions should be made at the lowest appropriate scale. Considerable debate has occurred over what this could possibly mean given the complex of interdependencies and cost/benefit flows discussed previously. This debate has been obscured by a lack of clarity about the different *roles* which water management organisations might play and the different *functions* which agencies may perform along water provision chains (i.e. from resource management – bulk supply and transport – treatment – distribution – waste/excess water removal). Simplifying greatly there are six different management roles:

– policy direction and ultimate responsibility;
– authority to perform operational functions;
– regulation and monitoring;
– resource allocation;
– coordination and consultation;
– conflict resolution and arbitration.

'Unbundling' these roles and functions helps understand the appropriate division of labour between actors (governments at various levels, private sector organisations, NGOs and community based organisations). As a general rule of thumb it is usually accepted that policy direction, regulation, resource alloca-

tion and coordination should all occur at a higher institutional level than those performing operational functions. In other words it is possible to envisage integrated service provision but with vertical service unbundling with different actors performing specific tasks at different levels of governance and spatial scales.

Figure 2 provides a generalised picture of the broad division of roles and operational functions which could exist between the various tiers of government and governance. However, there can be no fixed rules about the exact hierarchical distributions in specific countries. Much will depend on a country's size, physical geography and climatic conditions, population distribution, the dominance of particular sectoral activities within the national economy (including the dominance of major metropolitan communities), extant constitutional arrangements, human and financial capital endowments and many other factors.

For urban water services it has frequently been assumed that the existence of economies of scale and scope demand utilities capable both of providing conventional services across the entire urban area and of combining water source development, transport, treatment, distribution, sewerage and sewage treatment. There is limited evidence to support such assumptions (Shaw, Strong and

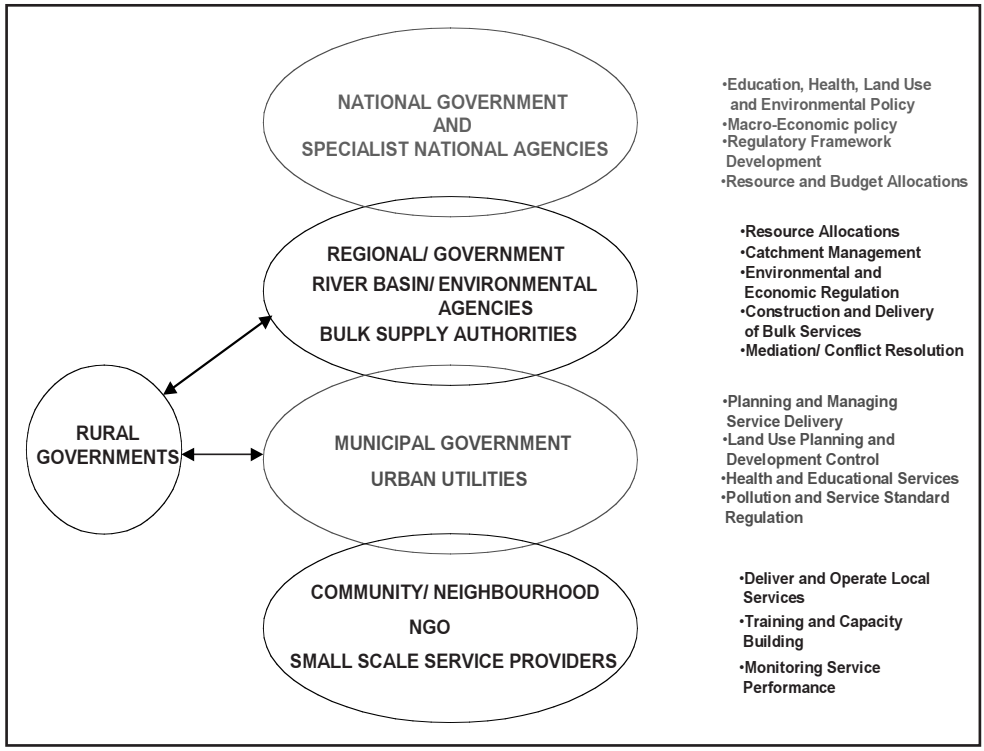


Figure 2: Spatial Division of Roles and Operating Functions

Webster Consultants, 2004). Most studies have found no evidence that integration between water and sewage services produces scope economies, indeed some have found that combined service provision is associated with scope diseconomies. Furthermore, although economies of scale in water supply distribution have been identified, these appear to be exhausted at relatively low levels of served populations or numbers of connections. The level where diseconomies set in will vary considerably between cities but most evidence suggests that optimal scale is likely to be around 1 million served population. Certainly in England and Wales, where the average population served per company with water is 2.4 million and with sewerage 5.3 million, there is evidence suggesting diseconomies of scale (OfWat, 2006). Where there do appear to be significant scale economies is in the production of bulk raw water supplies but the provider need not also be responsible for treatment and within city distribution. Since many of the UK water companies do have bulk supply functions, this would imply that local distribution diseconomies certainly set in before populations reach 2 million.

If such evidence, largely derived from advanced nations, is broadly applicable to the developing countries, then a very large number of urban utilities will have far exceeded their scale of operating efficiency and there would be few economic efficiency justifications in extending current monopoly power over the expanding built up areas. There may, however, be financial reasons for having very large utilities, if they can borrow investment funds at lower interest rates.

The evidence on scale efficiencies could be important for urban provision for two basic reasons. First, it gives decision makers flexibility to consider utility restructuring without incurring operating efficiency losses. For example, it may be feasible to split the city into separate utilities, as has been done in Manila and Paris, to facilitate *comparative* competition, cost transparency and accountability. It should be stressed that such separate companies do not compete directly (except potentially along the margins of their service areas) rather the separation allows the evaluation of their comparative performance. Lack of economies of scope could also allow the decoupling of water supply and sanitation, so getting away from the water supply driven approach to sanitation (World Development Report, 2004), allowing the development of demand sensitive technologies and enhancing abilities to more clearly differentiate between the provision of private goods (fundable from charges) and public good functions. Of course, in any restructuring attempts the transaction costs would need to be evaluated.

Second, it suggests that efficiency losses need not occur if alternative providers (including small scale private networks, NGOs or community groups) are allowed, indeed encouraged, to act in unserved areas or on the expanding urban fringe. In other words there appears to be scope for the spatial unbundling of service delivery (horizontal unbundling). This could facilitate market segmentation and the provision of services sensitive to the different needs and abilities to pay within the heterogeneous urban population. It could also help the introduction of directed subsidies to meet the poverty reduction or sustainable livelihood agenda, so avoiding the blanket subsidisation of the utility and its customers.

Crucially, horizontal unbundling also helps get over the critical investment cost problems which typically arise when attempts are made to enhance service provision across the city through large scale centralised schemes. Unaffordable master plans are left on the shelf and the situation continues to deteriorate as urbanisation continues. Wright (2005) cites the example of Bangkok in Thailand, where a technically sound but prohibitively expensive waste water master plan was devised in 1968. It was not implemented and numerous uncoordinated community waste water schemes were built. These improved local conditions but transferred environmental pollution and health risks to all urban residents by discharging waste to the canals (Khlongs) that criss-cross the city. In 1984 the master plan was revised to horizontally unbundled the city into 10 sewage zones, each with an independent collection and treatment system. The outcome was a more affordable, phased investment programme which started to be implemented in 1993.

Wright (2005) has advocated the use of a neighbourhood centred, demand responsive approach to sanitation provision and management, arguing that experience has demonstrated that "it is unbundling and decentralised approaches that have proved financially and technically feasible and manageable" (p.34). It is critically important to note, however, that the neighbourhood approach does not mean an uncoordinated, unplanned free for all. Rather it involves the development of a strategic sanitation plan for the entire urban area and the division of the city into distinct sanitation zones, which are large enough to capture the economies of scale in trunk sanitation provision but small enough to produce an affordable, manageable investment programme. Within this strategic context neighbourhood blocks then develop local service provision plans which meet local needs, financial means and environmental conditions. In the neighbourhood blocks all the investment, operation and maintenance costs are borne privately by residents but if waste

flows into the downstream zonal sanitation system then the neighbourhood residents become customers of the public service provider. Residents will, of course, require technical assistance with plan making, organisational arrangements, budget management, fee collection, resource mobilisation and system operation and maintenance. When successful the decentralised approach has several advantages:

- It is demand responsive with services tailored to local conditions.
- It allows a wider range of technical options to be used.
- It minimises free rider problems.
- It allows phased investments.
- It clearly differentiates between the private and public good segments of the sanitation service and shares the financial burden at different geographical levels.

It is clear from the neighbourhood sanitation example that decentralised systems do not mean that city governments and other higher tier authorities have no role. In essence spatial unbundling also involves functional unbundling with government retreating from some operational functions to concentrate on:

- Providing the strategic framework for small scale operations.
- Removing the institutional barriers to non-utility or non-municipal providers (Asian Development Bank, 2004, p.30).
- Ensuring that any arrangements for bulk water supply (or waste water collection) between the municipal utility and small-scale service providers are technically efficient, equitable and cost-related (Conan, 2004).
- Providing some regulatory mechanisms for performance monitoring, user and environmental protection.
- Ensuring that small scale providers (community groups) have the necessary resources, professional support, skills training and management back-up.

Unbundled provision systems essentially involve the creation of 'fit-for-purpose' partnerships between governments, utilities, NGOs, community groups and possibly small scale private providers. Two case examples of the successful implementation of decentralised sanitation systems, the Orangi Pilot Project in Karachi, Pakistan, and the condominial model employed in Brasilia, are given in Box 3 and 4.

Box 3: The Orangi Pilot Project

In Karachi approximately 60% of the total population of 13 million live in illegal subdivisions of state land (Katchi Abadis). Orangi Township is one such Katchi Abadis, which began as a squatter settlement in the 1960's but has since largely been regularised and land titles have been granted, it is now home to over 1.2 million people. As is typical in such settlements households made their own sanitation arrangements with concomitant pollution and health problems. However, when local government agencies attempted to install conventional sewerage systems within Orangi a cost-recovery problem arose immediately, residents believed the costs to be unaffordable and felt that a government provided public service should be free. The belief that the government should provide also removed incentives for self-help.

The Orangi Pilot Project (OPP), a non-governmental oragnisation, was established in 1980 initially with the objective of demonstrating to government that with community involvement cheaper, more appropriate local sanitation systems could be installed, maintained and paid for by local residents. OPP organised meetings in lanes that comprised of 20–25 dwellings and offered technical assistance to any lane willing to invest in their own infrastructure and create the management structure needed to collect funds and organise system maintenance. OPP's research concentrated on simplifying the design of sanitary latrines and sewerage lines to reduce costs to affordable levels (some $16–30 per household). It took six months before any lane group agreed to take responsibility for its sewerage system and approach OPP for technical help. Gradually others were formed as the benefits of the first scheme became evident and confidence was gained that the systems were financially and managerially viable. Initially, local government showed little interest in the pilot project but gradually political attitudes were changed and partnership arrangements put in place using the concept of component sharing between people and the government.

OPP has developed and refined its model for low cost sanitation based on the Orangi experience and the programme is now being replicated elsewhere in Karachi and in other Pakistani cities. One of the key features of the OPP model is the way the financial and management burdens of service provision is shared between the community and the state. Local inhabitants finance, manage and maintain the construction of latrines, lane sewers and small, secondary or neighbourhood, sewers (the so called internal development level) while government takes responsibility for 'external development' (large secondary sewers, trunk sewers and treatment plants). With this sharing arrangement it is perhaps somewhat ironic that a sanitation model which reduces government responsibility has actually led to it doing more that it has done previously for poor communities.
Source: Hasan, 1997; UN Habitat, 2003; Wright, 2005

Box 4: The Brasilia Condominial Model

Whereas the OPP model developed from the grass roots level and gradually came to involve partnerships with government bodies, the condominial system developed in the 1980s to serve low-income communities has become the standard system employed by government entities to provide urban sanitation. The condominial model has evolved over time and the Water and Sewage Company of Brasilia (Brazil's capital) has employed the latest version for 8 years.

In conventional sewage systems individual houses are connected to the public sewer, which limits the private element of the sanitation to property boundaries. The condominium (city block, square or its equivalent) model extends the private infrastructure to the boundary of the residential block, where the condominal branch sewer joins the public network. All the infrastructure costs within the condominium are borne by the residents, investments in the public network are the responsibility of the public service provider but the costs are recovered from sanitation charges. Community participation is very much part of the condominal model, with residents defining the block boundaries, being able to select different types of service, and having responsibility for monitoring jointly owned resources such as the condominal sewerage.

Not only is the condominal system cheaper to install than conventional house connections but the investment cost sharing increases the capacity of government to expand coverage. Phased system development is also aided by the practise of dividing the public network into a number of parallel micro-systems, based on small natural drainage basins, which receive waste from the condominial blocks. These micro-systems may operate independently, purifying the wastes within the drainage basin, but where necessary and financially feasible they can be connected to a citywide system.

The condominial model is, therefore, a decentralised system operating within a clear broader planning framework. It has the advantage of demand-responsiveness but with controls over the ability of individual communities to reduce the costs of their own sanitation provision by passing these on to others in the urban area and in downstream localities.
Source: Wright, 2005

One of the undoubted advantages of decentralised systems is that it does allow participation and people centred provision practices, which, as the Orangi and Brasilia cases show, can yield real welfare gains. However, participation has become a mantra in the water governance literature and its problems and limitations rather neglected; these can be significant as over forty years of experience with public participation in land use and environmental planning has demonstrated (see for example Lowe, 1977). Stakeholders have differential access to resources, knowledge and power. Unless carefully managed participation can reinforce these differentials, further marginalising the poor and already marginalised social groups and biasing decisions against those interests which have no well organised group/profession to give them a voice.

Participation tends to work best when communities are relatively homogenous in socio-economic terms but even in such cases community or participatory institutions can be captured by local elites (Cleaver, 2004). In addition, the costs of participatory mechanisms can be considerable. Stakeholder/community institutions have to be built, given knowledge and sustained over time and it has to be recognised that participation can increase not diminish conflict, producing costly, protracted adversarial confrontation and delayed project or programme implementation. There is also the problem of participation fatigue. For the urban poor the cost of engaging in consultation exercises can be significant as they struggle to meet their basic survival needs. As Simpson (2004) has asked, "when the rich can just turn on the tap, why do we expect the poor to engage in character building participation to get water?" In many urban contexts direct participation may be unfeasible and unwanted, what is necessary, however, is that transparent, accountable and trusted mechanisms for representation are in place.

6. STRATEGIC AND REGULATORY FRAMEWORKS

Decentralisation is not, of course, a general panacea for water sector problems. As Mody (World Bank, 2004) has noted, decentralisation is not, in itself, a solution to the problems of inefficiency and inequality in developing countries. Total decentralisation of all water management functions (resource management, supply provision, services, monitoring and economic/environmental regulation) flies in the face of a basic rule of institutional design since it fails to provide any checks and bal-

ances within the institutional structure. Moreover, there is a growing body of evidence that suggests that some functions are best provided through centralised, specialist institutions, where the best use can be made of scarce technical or regulatory skills and where there is a degree of insulation from local political pressures.

Since the 1980s municipal authorities have increasingly become the main actors in developing countries for the provision of basic urban water services as national governments devolved some of their duties. However, it is clear that they cannot and should not act alone. They frequently cannot because they lack the financial and managerial capacity to do so and should not because of the existence of the already discussed physical and human system interdependencies and because short-term local self-interest and political priorities may not be compatible with national social welfare and sustainable development goals. Local governments need to act within the strategic, regulatory and capacity development frameworks established by regional and national governments (although it is acknowledged that there are countries where no such frameworks exist in any meaningful functioning sense). As Bartlett et al. (1999) have argued, "one key aspect of an appropriate national framework for supporting effective urban government is the institutional means to reduce inequalities between wealthy and poor local authorities. Without this, decentralisation may simply consolidate or exacerbate inequality and poverty" (p.240).

It is instructive to reflect that in Britain, where water and sanitation were traditionally local government services allied to public health, a process of institutional reform began in 1945 to curb local autonomy. This process was a response to the inefficient piecemeal development of supply sources, the steadily worsening problems of ground water depletion and the pollution of ground water, rivers and coastal waters, the failure of neighbouring authorities within an urban conglomeration to coordinate service provision, highly variable service levels due to differential financial capacities, and declining service standards due to the neglect of unglamorous, non-vote catching expenditure on sewage treatment and the maintenance of water reticulation and sewerage systems. In other words exactly the sort of problems found today in metropolitan areas around the developing world.

The lessons learnt in Britain and elsewhere in developed countries are that local governments will not produce an efficient, equitable and environmentally sustainable development and allocation of natural resources unless they

operate within the context of a wider strong strategic planning and regulatory framework with effective implementation powers and sanctions. They will not necessarily use financial capital in ways which maximise long-term returns unless they are subject to some form of economic regulation; nor will they always act to serve the legitimate needs of all urban residents unless there are clear basic provision standards, monitoring, accountability and non-performance sanctions.

Decentralisation without higher level monitoring and regulatory capacity can have disastrous consequences for urban services provision if municipalities/ utilities are financially weak, have little managerial capacity, are corrupt or are managing in their own political or financial interests (McIntosh, 2003). Although it is widely accepted that private sector operators will require regulation of some form, it is often simply assumed that local governments or municipal utilities will automatically operate in the public interest because they are publicly owned; unfortunately all too frequently this is not the case. Likewise, the wider economic, social and environmental costs to the economy will be considerable if decentralised authorities are allowed to competitively develop or divert raw water sources, transfer their waste removal costs to downstream jurisdictions and make decisions based on short term political advantage not on longer term sustainability criteria. Decentralised systems necessitate the use of clear and transparent regulatory mechanisms such as, national legal frameworks which are enforced, independent regulatory agencies or tribunals or various forms of information based systems which basically work on the name and shame principle; a whole range of different mechanisms operate acceptably in developed countries (OfWat, 2006).

Regulation is so critical and yet so often neglected that it is perhaps worth emphasising the point by looking very briefly at pollution control from all urban sources (waste run-off, untreated sewage and industrial plants). Some of the externality costs from poor or non-existent control will be borne by city dwellers and municipal service providers, including water suppliers and health care services. These could, theoretically at least, be evaluated and controlled by municipal governments using an array of monitoring, pricing and command control tools. Monitoring and regulatory systems are not, however, free goods and the municipalities would need to devote significant financial and human resources to the task of monitoring literally thousands of pollution sources. Moreover, local politicians can be highly influenced both by strong industrial voices promising employment, growth and even political party funding and by fears of electoral backlashes if locally unpopular measures need to be taken.

Further, if municipalities themselves have responsibility for sewerage services, they are unlikely to effectively monitor and regulate themselves.

Therefore, even when the externality costs of pollution remain internal to the cities, there are arguments for involving a higher institutional tier to set effluent and waste disposal standards, impose pollution charging, provide specialist monitoring skills and impose sanctions for non-compliance with standards, at least where the largest and most damaging pollution sources are concerned. This argument applies even more forcefully where municipally owned facilities are polluters, including sewerage and sewage treatment, or where municipal failures are the root cause of the pollution problems, as is apparently the case in New Delhi (Venkatesan, 2006). It clearly also applies where, as is commonly the case, pollution costs are transferred to downstream (or coastal water) users; no city government is going to willingly spend its resources to benefit electorates in other jurisdictions. Clearly, simply transferring pollution control responsibilities to another tier of government, river basin or other agency will not automatically solve the problems. Not only would any regulator need to have clear powers and enforcement capabilities, be appropriately funded and staffed but it would require clear political (and moral) authority to withstand pressures from short term sectoral interests.

7. INSTITUTIONS FOR CO-OPERATION AND COORDINATION

In the previous section there has already been some discussion of institutions for co-operation and coordination in the sense that strategic frameworks and systems to regulate economic and environmental performance can and do promote coordination. The focus though was largely on single service performance. Such performance improvements are an important component in the IWRM process since, despite its name, IWRM is not just an integrative activity, it is about increasing efficiency, equity and sustainability. Integrating the operations of poorly functioning lower tier organisations is likely to add little of value in meeting IWRM objectives. However, there are, of course, critical aspects of IWRM which can only be addressed through institutions which have explicit remits to promote coordination and co-operation between sectoral actors and across jurisdictional boundaries.

This is not the place to rehearse all the coordination institutions that are of relevance to water resources in general. Rather consideration will, first, be given to the way different natural and human system interdependency relationships provide different coordination contexts for urban services management. Then second, there will be discussion of what institutions are available to promote cooperation and coordination between the service sectors and political jurisdictions across the metropolitan area and its rural environs.

It is frequently assumed that the most important interdependency linkages relevant for IWRM are those relating to water and associated land resources. In this case urban water services would be placed within the context of higher tier river basin organizations (RBOs) or catchment authorities, which would provide for or regulate urban needs in relation to resource capacity and competing uses. Clearly RBOs may play a vital role but they are not necessary in all countries nor are they sufficient to address the range of system interdependencies relevant to urban water management. In countries where RBOs do not exist the transactions costs involved in their creation might out weight the potential benefits. What matters is that there are institutional mechanisms to allocate scarce resources amongst competitors and to control externalities, not that these mechanisms are administered via a particular type of organisation. These mechanisms could operate through political choice processes at the national or regional scales or, indeed, where politically acceptable, through markets, using tradeable permits or pricing.

RBOs are not sufficient, first, because there are other natural system links which could be of equal importance to those in the water cycle and, second, because cities are vital components in those human systems which govern national social and economic development.

There are countries, the UK for example, where cities are placed in the context of an integrated pollution control (IPC) or an integrated environmental management system. The argument for IPC is based on the laws of thermodynamics, which dictate that matter is neither created nor destroyed. Waste products generated within the city and by the sectors that provide inputs into the city, have either to be reused or disposed of into one of four pollution receiving media – surface or ground water, air, land or the sea. In other words water pollution is seen as needing to be controlled as part of a much wider system to ensure that the least damaging environmental management options are employed. These options would include reducing waste generation, facilitating waste reuse and disposing of the residual waste to minimize environ-

mental, economic and human health costs. Given the fact that cities are typically responsible for a high proportion of the wastes generated in an economy, an IPC system may have advantages over RBOs which tend to focus on water pollution control post generation rather than considering environmental damage reduction more broadly.

It has already been said that major cities are critical growth engines for national economies, their development has, therefore to be coordinated with macro economic policies and social welfare priorities. It would be quite inappropriate, therefore, for water resource professionals or stakeholders in specific catchments to have a form of veto over water allocation or land use decisions which are important for the achievement of national development strategies. Moreover a successfully functioning city is also dependent on water use decisions throughout the area of its input footprint, which could extend over several river basin areas; once again it is unlikely that national or regional governments could afford to have these decisions made in ways which affected developmental opportunities in the urban area.

This all means that the WSSD's suggestion that IWRM plans adopt an integrated water basin approach will not be sufficient for large cities. As Jønch-Clausen (2004) makes clear, integrated water (or river) basin management and IWRM are different concepts and many "policy decisions affecting water management can be taken only at the national level, not the basin level".

Turning to the level of the city and neighbouring rural areas, it is inevitable that cooperation and co-ordination mechanisms will be needed to cope with the plethora of actors with interests in or influences on urban water services management. Typically, large metropolitan areas have far outgrown their original municipal boundaries and are characterized by fragmented jurisdictions most of which will have retained responsibility for some aspects of water service delivery. In some cities the water supply and sewerage functions may have gone to a larger utility but this is less common for environmental sanitation, defined broadly, drainage and the key areas of development planning and control. Within each local authority area urban services relevant to water will be delivered by several agencies/departments, some possibly with reporting lines to higher tier governmental bodies. Still more governmental actors are involved at the rural-urban interface and then there are all the spatial, social and economic interest groups competing over municipal resources and developmental opportunities and seeking protection from the development costs. In such situations no one can pretend that it is easy either to achieve signifi-

cant levels of co-ordination – complete co-ordination is impossible – or to get actors to behave cooperatively. Moreover, it is clear that the capacity to cooperate and the perceived need to cooperate will vary greatly between different actor groups. Rural local governments or community organisations may, for instance, have little capacity or power to 'force' their more powerful urban neighbours to cooperate over measures to reduce the impact of urban growth on agricultural livelihoods, see later the Chennai case in Box 6 (page 49).

It is sometimes argued that the IWRM approaches will produce win-win solutions making it in everyone's interest to co-operate. This argument may well hold over the long term if more sustainable resource usage and improved socio-economic conditions are demonstrably the result of IWRM activities and there are some cases where short term win-win gains may be achievable. For example, planned reuse of urban wastewater for peri-urban irrigation, with the implementation of locally appropriate and sustainable health risk reduction measures, can produce benefits both for the city and for agricultural communities. The former gains from having vegetable supplies with a lower health risk from microbial contamination and lower health care costs, while the latter benefit from a nutrient rich and reliable water supply which enhances yields and income levels (IWMI, 2006). However, most resource reallocations or curbs on freedoms of action will create immediate winners and losers, which given the typically short political horizons, makes it less likely that cooperation will occur naturally without incentives, enforceable regulation or crisis conditions.

At present there appears to be limited evidence in an urban water context on which organisational structures are most likely to further IWRM co-ordination objectives. Indeed it seems likely that there is no one urban model which has wide applicability. Some relevant experiences can, however, be found in the public administration and urban planning literatures. There has been a debate for at least 40 years over whether the coordinated delivery of all municipal infrastructure services necessitates local government reform and the creation of a unitary authority covering the whole of the built up area and responsible for planning, infrastructure, waste disposal, education, health and so forth. Some evidence from OECD reports does suggest that well managed, unified government, with clear strategies, has an impact on the social and economic development of cities and importantly gives local government more fiscal weight to attract investment (Davies, 2004) but the key words here are well managed.

However, local government reforms may not be politically feasible. Some, indeed, would argue that they are not desirable on transactions costs grounds;

for example, Bardach (1998) says "if there is one proposition on which consensus among students of public administration is firm and widespread, it is that reorganization normally produces little of value at a very high cost in time, energy and personal anxiety" (p.16). Others also oppose reorganisation but on public choice and local democracy grounds. Furthermore, it is well recognised that simply putting different professional or spatial political interest groups under one structure cannot guarantee they act cooperatively; power relations within the organisation can bias practice and funding, and decision making can become non-transparent with negotiations over priorities and appropriate actions hidden from public scrutiny. In addition the unitary approach would not address the rural-urban interface problem and would need constant re-adjustments to take account of rapid urban growth.

To cope with these last issues it has been suggested that a strategic planning structure should be created at city region level. This could take a statutory form with representatives of all the relevant municipalities forming a council/commission; it could be a professionally led specialist development agency with strategic planning and co-ordination functions (Davies, 2004) or it could be a non-statutory governance structure bringing together the public, private, community and voluntary sectors. There are examples of the latter being established by national governments; for example, the Local Strategic Partnerships in the UK are an attempt to improve the quality of public services and the development prospects in lagging urban regions (ODPM, 2005). In other cases such partnerships have arisen spontaneously, usually in response to crisis.

Coordination structures may be resisted by politicians and professionals alike (it is time consuming and reduces discretion) until the problems resulting from the lack of cooperation reach crisis proportions. Miranda and Hordijk (1998) cite one such example from San Marcos-Cajamarca in the Northern Andes of Peru. The area was hard hit by a cholera epidemic in 1993 and this prompted the provincial government and seven district municipalities, along with other private and public organisations to join forces in an effort to improve sanitary infrastructure. Their efforts to bring together funds, coordinate investments and other interventions (such as health education and awareness raising) were so successful that the group (CINDESAM) continued to work together on a wider programme including land and solid waste management. One of the key lessons from the group's success was that it concentrated on actions where consensus on the issues could be quickly reached, so not allowing conflicting opinions and interests to halt the co-ordination process.

However, whatever organisational arrangements are in place there will still be the need to encourage cooperative behaviour (or at least behaviour informed by information about decision impacts) within and between agencies/political bodies. There are several non-structural mechanisms which aim to do this, including:

- enshrining cooperative action in statutes (for example, requiring developers and local authorities to consult and work with the water/environmental sectors to create low input and environmentally sustainable developments);
- requirements that all public or private investments that affect the water cycle are subject to cba and environmental impact assessment;
- the need to obtain development or environmental consents before land conversion or water relevant investments take place;
- the implementation of hypothecated development or pollution levies on both public and private entities to fund infrastructure, risk reduction measures or compensation for those adversely affected;
- direct incentives and performance related "awards" for cooperation (Davies, 2004);
- creating and rewarding teams from different agencies to exploit complementarities and find new ways of working (Bardach, 1998);
- building an interagency data base or other mechanisms to improve information flows.

It is acknowledged that there are jurisdictions where any such measures would be simply ignored or circumvented or where there is simply not the human capacity to make the use of such tools a feasible option.

Although there are cases where cooperative action occurred without the development of some form of strategic planning process (the San Marcos-Cajamarca example is one such case) there are reasons to believe that attempts to promote cooperation work best when they operate within a strategic context with a clear vision of what the goals and objectives are. Such a strategic planning process would not seek to produce a fixed urban master plan (there are too many of these sitting on shelves long overtaken by development) but would be an ongoing and iterative process to capture changes in needs, technologies and capacities. In many countries the planning process would need to be participatory and transparent to create allegiance to the goals and accountability for progress towards achievement. It is evident that the process is often a very difficult one, particularly so when cities have very diverse social compositions and have a multiplicity of municipal governments with big differences between them in their competence, capacity and revenue bases.

8. POLICY TOOLS AND IMPLEMENTATION PRACTICE

Clearly IWRM tools would include those discussed above which relate to integration and co-ordination. In this section the focus will be on two issues – the instrument mix (often called the policy mix) needed to achieve specific public objectives and the importance of implementation practice in determining whether such tools are employed in ways which allow these public policy goals to be met and are IWRM compatible. It is not the intention here to dwell on the details of specific policy tools, most of which have been extensively covered in the literature, including the GWP's ToolBox.

The tools or policy instruments available to different levels of government or governance vary but the relationships between tools and institutional scale are not simple and straightforward, in part because there is not a single water product or service which the tools could be employed to provide, nor one single objective to be achieved by their use. Moreover, the available tools will vary between countries, depending, for example, on hydrological conditions, constitutional arrangements, cultural norms and human capital endowments. In addition the tools notionally available may not be implementable in practice or will have limited effectiveness if not supported by decisions and implementation practices elsewhere in the system.

Even if we take a single service, urban water supply, and a highly simplified view of managerial goals, a large number of potential tools emerge although the list is by no means complete (Figure 3). As UN Habitat (2003) points out in the discussion on DSM as part of an IWRM approach, "demand side strategies should be able to accommodate multiple goals, and that – as with other aspects of IWRM – the relative importance of these goals need to be location specific" (p.198). Both DSM and IWRM should indeed be able to serve multiple goals. But multi-objective development planning is a complex undertaking; having too many, not necessarily compatible, goals can simply stop any real action and to make progress it may be necessary to simplify and prioritize goals over different time frames. Furthermore, to cope with the different objectives it is necessary to develop tool packages, which typically will involve concerted actions from different institutional levels and by several non-water actors.

Level	Goal	Tools
Household/ Community	Conservation Supplies	In factory/ in house recycling
		Rain Water Harvesting
		Water efficient Consumer Durables
	Provide Basic Needs	Small scale community networks
		Authorised Private vendors
Municipality/ City Utility	Conserve Supplies and/ or Reallocate Supplies	Leakage Control and Network Maintenance
		Planned Reuse at Urban Scale
		Dual Supplies
		Cost-based tariffs and metering
		Retrofit water using equipment
	Health Improvement and Basic Needs	Targeted subsidies
		Education on Water Hygiene
		Facilitating community level provision
		Removing land tenure restrictions on provision
		Prevention of waste infiltration into supply
	Increasing Investment	Cost-based tariffs
		Improved Revenue Collection
		Improved operating Efficiency
		Curbing illegal connection
	Source Protection or Supply Quality Protection	Ground Water Abstraction controls
		Leakage Control-curb infiltration
		Land Zoning
		Industrial/ Domestic waste Pollution Controls
Basin	Supply Enhancement	Purchase upstream water or waste disposal rights
		Buy catchment Protection services
	Supply Enhancement and Supply Quality Protection	Authorise Physical Enhancement Schemes (dams, recharge)
		Regulate Catchment Land use
		Regulate waste and storm water discharges
		Implement Pollution taxes
	Reallocate Supplies	Regulation abstraction
		Institute abstraction pricing
		Introduce water trading
		Introduce consultation/ conflict resolution
Sub-National/ Regional Government	Enhance Municipality/ Utility Performance	Monitoring, Benchmarking and Publicity
		Facilitate skills/ human capacity improvements
		Provide public loan facilities
		Consultation/ Conflict Resolution re land use priorities
National Government	Goal Prioritisation	Establish policy principles for land and water allocation
		Establish regulatory frameworks
		Monitor sub-national/ basin level agencies

Figure 3: Urban Water Supplies: Institutional Level, Goals and Tools

Just to take one simple example with only two objectives, governments may look to urban utilities to both improve their operating efficiency and meet the needs of the currently unserved, largely poor, urban populations. It has frequently been assumed that increased cost-reflective tariffs and greater utility productivity will increase capital flows and available water supplies and so allow service extension. This assumption may be correct but there are other feasible scenarios:

- A municipality may simply employ the additional revenue to fund high profile, politically advantageous projects which have nothing to do with the needs of the poor.
- National governments may see the improved financial health of the utility as an opportunity to reduce its grant aid for investments.
- Utilities (public and private) will still have no incentives to extend their networks if the costs involved exceed the prices the poor are willing and able to pay.
- Suppliers may be prohibited by law from extending services to unauthorised squatter settlements.

If governments place a high priority on serving the urban poor then they will have to take other actions, such as requiring the separation of the water budget from general municipal funds; providing targeted subsidies to allow the utility to serve poor customers as is done in Chile – see Box 5 (Peña et al., 2004); providing direct social welfare payments to allow the poor to better pay for service provision (World Bank, 2005); requiring utilities under contract or regulatory controls to extend coverage and cross-subsidise services for the poor; and changing the legal status of unauthorised settlements.

Box 5: Full cost Pricing and Targeted Subsidies – the Chilean Case

The Chilean experience of urban water supply and sanitation is an interesting one in many respects. First, it has not followed the trend of decentralisation to municipalities; second it has developed a competent national economic and environmental regulatory system; third it has increasingly involved the private sector and fourth it has instigated a full cost recovery policy with targeted subsides. It also clearly illustrates the importance of macro-economic policies, apparently unrelated to water, in influencing the institutional arrangements, management tools and performance of the sector.

A National Water Supply and Sewerage Service (SENDOS) was created in 1977 with responsibilities both for the operation and maintenance of urban water ser-

vices and for the regulation of existing public operating companies. Under SENDOS tariff policies were gradually reformed to achieve operating and investment cost self-financing and the elimination of cross-subsidies between consumer groups and regions. Towards the end of this reform process in 1989 targeted subsides were first introduced. In 1990 SENDOS was superseded by the Superintendency of Water and Sanitation (SISS) and operating functions were separated from monitoring and regulation. SISS was responsible for regulation, while largely public companies were the service providers. Regulation through a 'model' company approach used a form of comparative competition to enhance company performance. Major improvements were made to service coverage but sewage treatment was limited so causing health and environmental problems. The policy decision to introduce widespread treatment added markedly to the capital needs of the sector (some $2 billion) and was the main reason for privatising the public companies from 1998 (over 77% of the urban areas are now covered by private companies). However, privatisation has occurred within the context of a well established regulatory system and was accompanied by legislation strengthening consumer rights.

Although the public acceptance of full cost pricing was due to a number of factors, including the buoyancy of the national economy, undoubtedly the existence of the targeted subsidy programme played a role. Expenditure on basic services represents a significant proportion of household expenditure for the lowest income groups and cost-based pricing involves a regressive redistribution of real income unless the poorest are helped. Subsidies from the state go through a municipally run system which identifies the lowest income groups and partially pays their monthly water and sanitation bills, partial payment helps avoid wasteful usage behaviour. Inevitably, to achieve the welfare objectives, the level of national government contributions has had to keep pace with cost-based price rises; both the number of people subsidised and the average value of each payment has increased significantly over time. A key issue for any targeted scheme is to ensure that the subsidies actually reach the poorest groups; this appears to broadly be the case, with, in 1998, 60% of total expenditure going to the two lowest income groups.

Source: Peña, Lurashi and Vanenzuela, 2004-5

Similarly if we look at urban sanitation, a policy mix will be required to help meet the Millenium Development Goals which will need to involve actors at all levels of governance. The Task Force on Water and Sanitation 2005 (Table 4.6) suggests five possible policy and planning options – land tenure reform; social marketing and education; partnerships with civic organisations; regulatory reform (largely to remove overly stringent technical standards) and innovative technologies. Of these only partnerships are clearly a local government matter, working alongside NGOs or community groups. Social marketing and education campaigns to generate demand and influence decisions at the household or community levels may, be best coordinated through higher level institutions. Land and regulatory reforms must be national or regional government concerns, while the sponsorship of research in innovative technologies and technology transfer is also likely to best occur at the national government level, with international cooperation. The point is that the policy objectives are only likely to be met if there is a clear strategic approach with policy packages developed and implemented in concert.

A critical component of any policy mix package must be measures to address the question of capital availability, including appropriate financial tools and cost sharing. Although in the sanitation case the internal (private) – external (public) model employed in the OPP (Box 3) provides one solution to financial burden sharing within the city, it does not meet the financial challenges of providing for pollution control outside the sewered area. This is clear in Karachi where the Orangi systems along with most other sewerage networks discharge untreated wastes into the natural drainage channels of the city and thus to the sea, with all the concomitant health and economic losses (Channa and Moora, 2004). In most now developed countries water supply, bulk sewerage and sewage treatment were seen as public goods heavily subsidised from general taxation; only relatively recently have moves been made to recover all or a significant proportion of the costs involved from individual households. In other words the financial tools employed and the distribution of costs has shifted over time in part in response to shifts in the willingness and ability of individuals to pay for the services. Such a staged approach may have relevance for developing countries today as can be seen from the Chilean case study. While recognising the acute capital constraints faced by national governments, national government funding will be vital to the achievement of the MDGs in most developing countries. Ideally national contributions should be targeted at the poor and/or to parts of the water service which have clear public good elements, such as pollution control, health education or catchment management.

Turning now to implementation practices and IWRM objectives, it is clear that there are relatively few urban water management tools which are automatically compatible with the objectives of IWRM; indeed these objectives (efficiency, equity and environmental sustainability) aren't unequivocally compatible with each other. The fact that a service provider is employing a tool listed in the ToolBox or manuals on DSM techniques does not mean they are adopting an IWRM process. One example has already been mentioned during discussion of the tool packages required to make efficient charging and operating practices compatible with equity and service provision to the poor. It demonstrates that demand management tools, which can play a crucial role in implementing IWRM approaches, need not be employed in ways which are compatible with overall IWRM objectives. One of the difficulties with DSM tools which employ the logic of economic markets is that their blunt use can lead to the neglect of both social equity and environmental sustainability, unless measures are taken, as they were in Chile, to temper such neglect. IWRM is about balancing objectives and as such cannot be achieved solely by tools which are designed to meet only one objective.

It goes without saying that putting a tool package in place which requires coordinated actions by several different actors, is much more difficult than employing a tool within municipality or utility control. Likewise, objective balancing and prioritisation are difficult tasks even within one organisation, but are even more difficult when the blame for failure to meet a particular goal falls squarely on one particular party, meeting that goal becomes "mission" critical and others are secondary. Objective balancing becomes even more problematic when it involves current utility customers or local electorates being forced to bear costs in order to reduce the costs borne by those in other jurisdictions or time frames. Such difficulties are demonstrated in the case study of Chennai, India, Box 6. It also shows quite clearly that a tool, which in the right circumstances can advance the IWRM process, can be implemented in ways that are incompatible with the basic sustainability criterion.

Box 6: Chennai – Rural to Urban Water Transfers

Water right or water usage right trading can be an important IWRM tool to improve resource efficiency by reallocating available supplies to higher value purposes. However, trading can have major third party effects which, if neglected, could mean that the social costs involved exceed the private benefits, which does not produce an efficient result for the economy as a whole. Trading in

Chennai has profound social and environmental consequences which are not taken into account in decision making.

Chennai, the capital of Tamil Nadu and the fourth largest city in India, suffers acute water shortage problems, created both by the physical water regime and by past management practices. The area is dependent on the unpredictable North East Monsoon; the only major river system, the Cauvery, is an interstate river with its source in neighbouring Kamataka and is the subject of a bitter water sharing dispute currently before the Indian Supreme Court for adjudication. Urban development has appropriated many of the old tank (reservoir) areas traditionally used to store monsoon rains and ground water sources have been severely depleted, salinised and polluted. Overpumping of the aquifer (by both the municipal supplier – Metrowater – and private abstractors) continues despite the nominal existence of abstraction controls with Metrowater holding enforcement powers.

To cope with the supply situation Metrowater has purchased water rights and developed sources at progressively greater distances from the city. More recently the municipality and Metrowater have instituted a number of demand management measures:

- A leak network detection programme has begun but losses remain high in unrenovated sections of the network.
- Waste water re-use occurs with large industries purchasing, treating and re-using sewage effluents for cooling and process water.
- Community education programmes encourage conservation.
- Mandatory rainwater harvesting has been introduced for all buildings to help aquifer recharge.

Metrowater has for long developed its own wells to tap groundwater, although some of these can no longer be utilised due to saline intrusion over 8 km inland. However, to curb investment costs and achieve a rapid response to supply needs, the agency has also turned to private well owners (mostly farmers), placing them under supply contracts. The agency now calls for tenders from private well owners to supply at a given fee rate, which has been increased to achieve the required supply levels. In response to the tenders not only have existing private abstractors sold their annual usage rights but new tube wells have been sunk specifically to sell on water. In addition to city water users two other groups have benefited from trade – truck tankers owners and the land owning farmers making sales. There are, however, losers – the landless peasants who are no longer employed, all farmers who have not chosen to sell and all previous users of the ground water for domestic or commercial purposes. These last two losses occur because of the inevitable decline in ground water levels

due to competitive overpumping and the increased pumping costs. Ground water levels have fallen by 60–80 feet in the last 20 years and whole areas face the permanent problem of saline intrusion. Metrowater has the option to move on when pumping is no longer feasible but the salinisation of a valuable common property resource will remain. There are no controls over water trading and no mechanisms to compensate those third parties affected by the trade – the result need not be efficient and is certainly neither equitable nor sustainable.

Source: Appasamy, 2005; Raju, 2004

It is worth pointing out that even the creation of organisations charged with implementing IWRM might not do so in ways which are compatible with the socio-economic and environmental objectives of IWRM. Much will depend upon the type of organisation created, the professional background of its personnel and on the ways the organisation inter-reacts (if meaningfully at all) with stakeholders. If, for example, the river basin organisation (RBO) is established basically as a resource development agency, staffed by engineers, then the outcomes may fail to meet both the distributive equity and environmental sustainability objectives of IWRM. On the other hand if the agency is established as an environmental conservation organisation, staffed by environmental scientists and pollution regulators, then the social equity and developmental objectives of IWRM may be neglected. Alternatively, if an RBO is created primarily as a stakeholder bargaining forum then the outcome could be that nothing is achieved except the further entrenchment of vested interests. As GWP TEC (2004) points out, "(t)here are numerous examples of river basin organisations that didn't take. For example, China created Basin Management Committees… (which) focused only on irrigation" (p.23).

9. CONCLUSIONS

It has been argued that there is a need for an IWRM approach to urban management to reduce the externality and opportunity costs which arise from segmented management systems and to ensure that services can be provided on a sustainable basis. An IWRM framework for decision making does not imply the need for wholesale administrative reorganisations and the creation of mega service delivery agencies theoret-

ically capable of internalising all the externalities and maximising cost saving. Nor does it imply the creation of top-down decision systems which are likely to be poorly responsive to the highly variable social and economic situations found throughout the city. Wright (2005) has argued in the context of urban sanitation provision, "integrated urban services delivery is best viewed as a framework for thinking about, and delivering, urban services… an approach which ensures that, in delivering every urban service, steps are taken to ensure that the new development is in harmony with other services that have been designed or are in place already" (p.35).

While IWRM is indeed a framework for thinking not only at the municipal level but right through the water governance hierarchy, thoughts have to translated into actions which gradually move the water services delivery systems and urban management generally into more efficient, equitable and sustainable forms. IWRM is not a quick fix process. There are no simple panacea solutions to the urban water challenge; unsustainable, inefficient and inequitable practices have become embedded and it will inevitably take time to change political, cultural and professional attitudes and behaviours.

Although urban water and sanitation services are now typically regarded as a local matter, an IWRM approach shows clearly that they cannot be seen as solely local issues given the range of human and physical system interdependencies which need to be addressed. While local provision functions may be appropriate to allow demand centred provision, greater transparency and accountability, higher tier governments cannot abdicate responsibility. There are management and governance roles which cannot, or should not, be undertaken at the local scale. For policy direction, the establishment of strategic frameworks, capital and water resource allocations, economic and environmental regulation, the lowest appropriate governance level will rarely be at the local or even at the metropolitan scale. No one pretends that IWRM approaches are easy but business as usual is no longer an option.

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GWP Secretariat
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