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# ACCESS TO SANITATION AND SAFE WATER: GLOBAL PARTNERSHIPS AND LOCAL ACTIONS

# Integrated resource planning: a vital tool for utilities in low-income countries

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A rapidly increasing global population, coupled with effects of climate change inevitably lead to a decreasing per capita fresh water availability for the world's inhabitants. In response, water professionals in some developed countries have adopted Integrated Resource Planning (IRP), which evaluates both demand and supply options using multiple criteria, for sustainable urban water management. Water professionals in lowincome countries can learn from this experience, through existing global partnerships such as the WEDC Conference and IWA specialist groups. This paper describes the basic concepts of IRP, highlights its importance and briefly states how it could be adapted to the operating environment in low-income countries.

#### The dwindling water resources

The global population has continued to increase rapidly. According to the most recent UN world population prospects report, the world population reached 6.7 billion in July 2007, 5.4 billion of whom live in the less developed regions (United Nations, 2007). Assuming a declining fertility rate, the world population is projected to increase to 9.2 billion by 2050, which increment will mainly be absorbed by less developed regions (ibid). Since there are finite water resources on earth, this rapid population growth has resulted in a decreasing per capita water availability. But the other problem is that the world's freshwater is poorly distributed across countries, within countries and between seasons. Hence, practical distribution problems concerned with time, space and affordability lead to a widening gap between demand and supply in many parts of the world.

The water scarcity situation is compounded by the major impacts of climate change on the water resources, namely shorter duration of the precipitation seasons and an increase in hydrological extremes (Stern, 2007). Shorter precipitation seasons, coupled with overall larger annual precipitations lead to larger runoff volumes generated over shorter time intervals, which in turn creates complications in designing for storage and routing of floods. Furthermore, the opportunity time for groundwater recharge is reduced, which undermines the efficiency of conjunctive utilization of surface water and groundwater. If these climate changes continue at current rates, there is predicted to be a serious reduction in dry-season water availability in many regions of the world within the next few decades. One recent study predicted that a temperature raise of 2°C may result in 1-4 billion people of developing countries experiencing water shortages (Stern, 2007).

The water scarcity situation will get worse in the world's urban areas , which have grown to the extent that since early 2007, urban areas account for over half of the world's population (UN-HABITAT, 2006). Between 2000 and 2030, it is projected that there will be an increase of urban population of 2.12 billion, with over 95% of this increase expected to be in low-income countries (UN-HABITAT, 2004). Parallel with this growth in population, the demand for drinking water has been increasing rapidly in urban areas, in line with raising living standards. Yet the number of viable water resources in any region is limited and has to serve competing requirements such as domestic, industrial, irrigation, fishing, navigation, tourism, recreational, ecological demands and waste disposal/assimilation.

This alarming growth of water scarcity, coupled with widespread environmental degradation has brought into focus the need for planned action to manage water resources in a more effective way. The dwindling water resources need to be optimally managed while minimising negative impacts on the environment. Whereas there have been efforts on the catchment level to move towards integrated resource management in the past few years, this approach has not caught on so well in urban areas. The conventional urban water management concepts have continued to focus on individual sectors such as water supply, sanitation and drainage. Recently, water professionals in Australia and the US have adopted Integrated Resource Planning (IRP), a planning framework that originated from the energy sector, which embraces wider strategic planning principles and fits well within the integrated urban water resources management paradigm. This paper describes the basic concepts behind IRP, and evaluates how it could be applied to the operating environment of most water utilities in low-income countries.

# What is Integrated Resource Planning (IRP)?

IRP is an approach that was first applied in the energy sector in the United States in the early 1980's, after recognising the limitations of focusing on only construction of power supply infrastructure. In contrast, IRP is a planning process in which a full range of both supply-side and demand-side options are assessed against a common set of planning criteria (Turner et al, 2006). The guiding philosophy for IRP is that utility customers do not necessarily demand a resource itself but rather they demand the services that the resource provides, often called end uses. Hence, IRP shifts the focus of attention from the quantity of water delivered to the quality of service provided. As such, consumers are perceived to generate demand for the end uses, such as clothes washing or toilet flushing, rather than a demand for litres of water (White & Fane, 2001).

IRP may be defined as a comprehensive form of planning that uses an open and participatory decision-making process to evaluate least-cost analyses of demand-side and supply side options (Turner et al, 2006). It is a process in which water utilities determine the least cost options that they can use to provide their customers with water-related services that they demand rather than the water per se (White & Fane, 2001). IRP is a systematic planning process that identifies the most efficient means of achieving the goals, while considering the costs of the project impacts on other societal objectives and environmental management goals (Turner et al, 2006). Table 1 shows the major differences between traditional supply-led planning and IRP.

Table 1. Comparison between traditional supply planning and IRP (Source: Turner et al, 2006)		
Criteria	Traditional Supply-led Planning	Integrated Resource Planning (IRP)
Resource options	Supply options	Demand and supply options
Resource ownership and control	Utility-owned and centralised	Some resources owned by other utilities, other producers, customers
Plan selection criteria	Minimise costs and maintain system reliability	Diverse criteria including risk reduction, environmental quality, economic development
Objectives	single	multiple
Role of public groups	interveners	participants
Supply reliability	Constraint and high priority	Decision variable

Figure 1 shows a simplified process chart for IRP. The IRP process is fully participatory and it is therefore important to start the process by mobilizing the key stakeholders to agree the purpose, form and scope of the IRP framework. The key steps of the IRP process include: (i) collecting data to enable accurate water demand forecasting and detailed options development; (ii) demand forecasting using a detailed end use analysis which considers demand by sector, individual end uses and how they change over time, considering projected behavioural, technological and demographic changes; (iii) developing the response by (a) carefully considering various types of demand management, source substitution and reuse options, (b) analysing individual and grouped options/scenarios using a common metric, (c) carrying out a sensitivity analysis, and (d) optimising the response; (iv) carrying out a pilot study as a stage towards full implementation; and (v) monitoring and evaluating individual programmes and suites of programmes; and reviewing the IRP process.

# Why is IRP important for urban utilities in low-income countries?

It is important for urban water planning that the stakeholders agree and define the significant drivers for action, and how water resources planning and management relates to these issues. One universal justification for applying IRP is the need for utility managers to adopt options that will ensure sustainable urban water resources management. Different utilities will have other overriding drivers, depending on the context. For



instance, a major driver for utilities in Australia and the USA has been the persistent drought conditions in these regions. The situation may be different in many low-income countries, where there is no comparable deficiency of water resources in the utility's catchment area. Water utilities in low-income countries may need to carry out IRP as an avenue for incorporating demand management (DM) approaches, which has hitherto received little attention from most urban water managers in the developing world.

DM approaches are important to utilities in low-income countries for several reasons. Urban water utilities have not coped with demands from the escalating urban populations, mainly due to inadequate capacity in terms of capital finances, human resources and institutional framework. Low-income settlements of many cities in developing countries receive poor or no service from the utility mainly due to low density of the distribution pipelines, low production capacities at the treatment plants, and/or a combination of both. As a result of the latter, many water distribution networks are operated in an intermittent water supply mode. Another contributing factor for intermittent water supply is the high levels of non-revenue water in many distribution networks, sometimes ranging over 50%. IRP could be applied to the different situations to establish whether DM tools could be applied both on the utility and the end-users' to turn the situation around, or even make a viable difference in enhancing the service levels.

Connected with the point mentioned above, if water utilities in low-income countries have to operate the water distribution network intermittently, the question of equitable distribution usually comes into play. Experience has shown that usually the rich and most powerful in society obtain higher levels of service than the vulnerable. The advantages of the richer members of society stem from three main factors: (i) they normally live in the best town locations which are well networked with probably better hydraulic properties; (ii) if they live in geographical locations which cannot induce good hydraulic properties during flow regimes, they usually have the capacity to invest in coping strategies; and (iii) they have a higher influence in the decision-making process for water service provision.

#### How could IRP be adapted by utilities in low-income countries?

IRP is a new concept, even for some utilities in developed countries. Its application requires not only a multiskilled planning team, but high quality data. In line with the theme of this conference, water professionals in low-income countries could, through global partnerships such as the WEDC Conference and International Water Association (IWA) specialist groups, learn from the experience of their counterparts elsewhere to adapt such new and useful concepts, and apply them through suitable local actions to their operating environment. For instance, IWA Specialist Group on 'Efficient Operation and Management of Water Systems' has set up task forces on 'International Demand Management Framework', which aims at adapting IRP concepts to different international situations, and on 'Water Utility Efficiency in Low And Middle Income Countries'. Table 2 shows key elements of the IRP that need to be re-examined when applying it to a typical utility in low-income countries.

Table 2. Adaptation of IRP to suit operating conditions in a typical low-income country		
Item	Issues calling for re-examination	
Stakeholder participation	Need for mobilisation for participation. Municipal departments' participation is critical; Widen the scope to include users' associations, academia, government, the private & NGO sectors.	
Data collection	Start with available data; aim at incremental improvements in quality and quantity of data	
Demand forecasting	Start with sector aggregation; carry out case studies in different market segments; cater for various levels on the sanitation ladder including low-cost sewerage; cater for town expansion	
Options analysis	Cater for improved service levels in line with improving living standards and hygiene & public health education; consider affordability and willingness to pay at household & national levels;	
Implementation	Seek political buy-in by emphasizing monetary benefits; start with a pilot project & scale up.	

# Conclusion

The escalating water scarcity coupled with serious negative environmental impacts currently being experienced in many countries compel water professionals to rethink the way they manage the water resources. Instead of focusing on only supply-side options, urban water managers in low-income countries need to apply IRP, which has aligned water professionals' planning orientation, process and scope towards sustainability. Through global partnerships such as the WEDC Conference and IWA specialist groups, water professionals in low-income countries could learn from their counterparts, adapt the planning criteria to suit the operating environment, and effect local action that will ensure sustainable urban water management.

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