A RESUMÉ OF WORLD BANK WATER AND SANITATION EXPERIENCE OF VALUE TO SOUTH AFRICA

Kevin Wall Pr Eng TRP(SA)

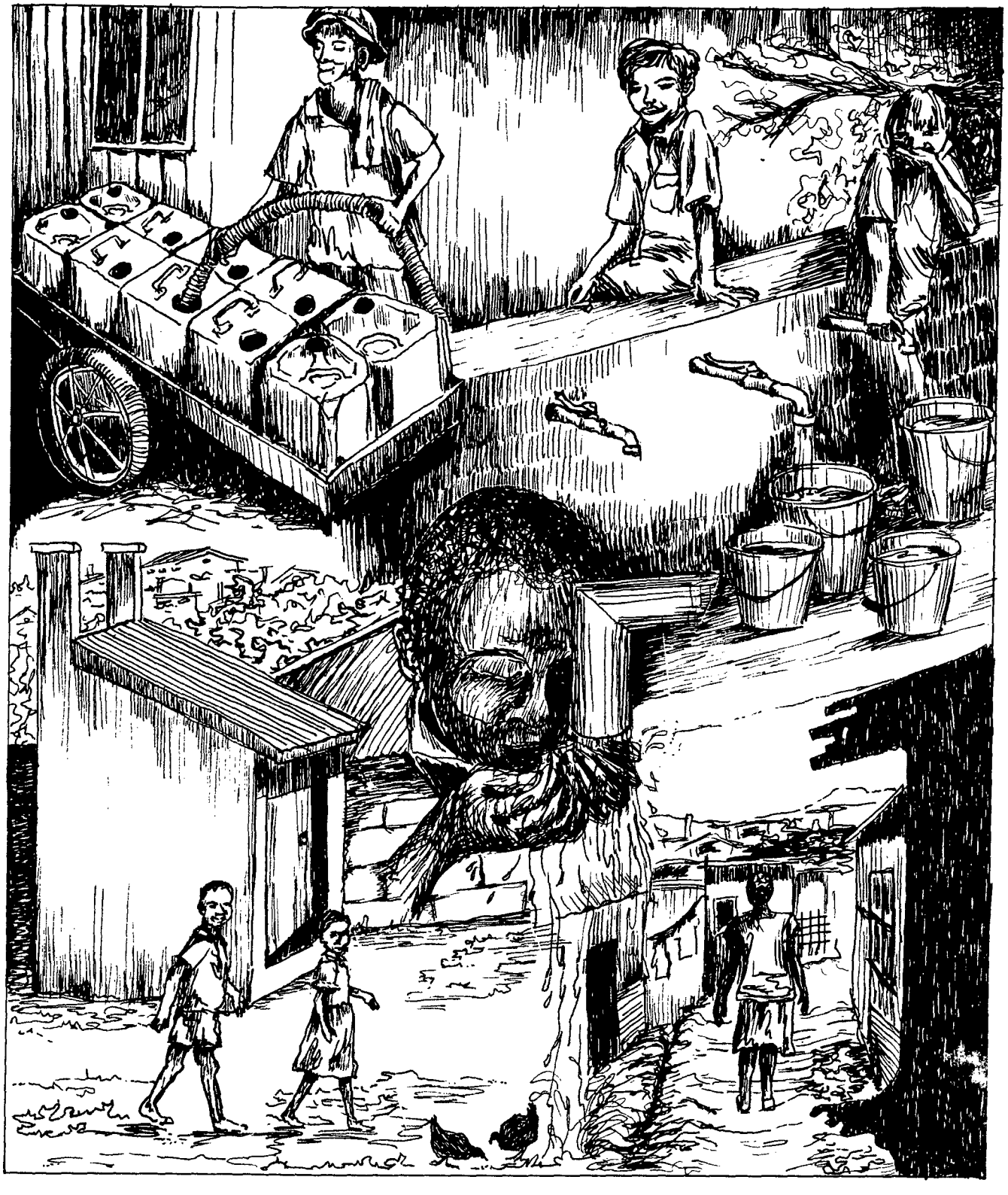
KV 126/00

Water Research Commission

A RESUMÉ OF WORLD BANK WATER AND SANITATION EXPERIENCE OF VALUE TO SOUTH AFRICA

KEVIN WALL Pr Eng TRP (SA)

KV126/00
ISBN 186845 601 3



EXECUTIVE SUMMARY

Kevin Wall, Consultant to Ninham Shand Inc, has been appointed to investigate and report his sabbatical year findings on water and sanitation experience appropriate to the developing urban and peri-urban areas of South Africa.

The emphasis is on studies documented by and current thinking in international agencies (particularly the World Bank, and the UNDP - World Bank Water and Sanitation Programme, but also the Environmental Health Project and others).

This objective is achieved as follows:-

- introduce the concerns reported by international agencies: Chapter 4
- describe and examine experience in water consumption and sanitation technologies: Chapter 5
- describe and examine experience in institutional, legislative and financial issues : Chapter 6
- describe and examine experience in economic issues: Chapter 7
- describe and examine experience in environmental and social issues: Chapter 8
- describe and examine experience in cost, price and affordability issues: Chapter 9
- overview and summarise approaches and experience: Chapter 10

Conclusions are drawn in Chapter 11.

It is found that the challenges facing developing countries in infrastructure provision, particularly in the water and sanitation sector, are formidable. Rapid population growth and urbanisation is stretching the physical capacities of infrastructure and the limits of the natural ecosystem. Government budgets cannot accommodate competing demands for investment resources. Many public institutions in the sector suffer from weak management and a lack of an incentive structure to motivate genuine reform. Many initiatives in the sector fall short because they are inflexible, nonparticipatory, and unsustainable for a variety of reasons.

The challenges in water and sanitation provision can conceptually be viewed as two closely related agendas, as follows:

The first challenge is to complete the "old agenda" of providing household services. Although considerable progress has been made, much remains to be done. A thousand million people still lack access to an adequate supply of water, and 1700 million do not have adequate sanitation facilities.

Despite the number of urban people with adequate facilities increasing by about 50 per cent between 1980 and 1990, because of growth in urban population the number without access to adequate sanitation actually increased by about 70 million!

Furthermore, the quality and reliability of existing services are often unacceptable. To compound the situation, the costs of providing services are rising substantially because of rapid urbanisation, mis-management of water resources, and the low efficiency of many water and sanitation supply organisations.

Over the past thirty years developing countries have allocated an increasing share of their gross domestic product (GDP) to public spending on the provision of local domestic (i.e. for residential areas) water and sanitation services. It would appear that the proportion of public spending on these local services has not been appropriate, for three reasons: Firstly, the low contributions of domestic users have meant that supply agencies have not felt obliged to provide an adequate service, and to provide it to all consumers; in a sense, they have felt that they are not accountable to consumers. Secondly, this spending has been used primarily to provide subsidised domestic services to the middle and upper classes. Thirdly, spending on domestic services has left few public resources available for wastewater treatment and management at the wider urban or metropolitan scale.

The second challenge is the "new agenda" of environmentally sustainable development. In some respects, viz, high costs and limited resources, the situation confronting developing countries is similar to that faced by industrial countries. But in other respects the task for developing countries is considerably more difficult. Water in developing countries is much more seriously degraded and is deteriorating rapidly; far fewer financial resources are available for environmental protection; and institutional capacity is weaker.

The report finds a changing emphasis of the international agencies involved in water and sanitation provision -

- from single focus projects (eg. focus on technology, or on preventive health, or on hygiene education), to
- more integrated approaches to the provision of infrastructure and the provision of health.

This is accompanied by other shifts in emphasis, particularly -

- from primary attention on rural issues, to primary attention on the cities,
- from top-down approaches, to approaches that are a judicious mixture of top-down and bottom-up,

- from focus on construction costs of facilities, to focus on lifetime costs of facilities (i.e. including operation and maintenance), and
- recognition of the need to ensure the financial and environmental sustainability of projects.

Key issues described and points made in the report include:

- The choice of level of service and of the technology are vital in suiting the particular circumstances at any location. Many of the technologies described in the publications of international agencies can be used to provide effective and efficient services for the poor which are at the same time affordable and for which householders are willing to pay.

- Moreover, if the scale of the technology is reduced, there is a greater potential for community-based water and sanitation systems and for private sector involvement in these systems. Small-scale, low-cost technologies are needed in the developing world. If the technology does not have major capital requirements, community groups and small private enterprises will usually be better able to provide the services.

- Adequate institutional provision for water and sanitation involves diverse skills and capabilities, many public and private actors, and a range of tools for capacity building - some of these may have to be innovative. Promising directions include partnerships in which nonformal institutions (such as neighbourhood associations) manage the feeder infrastructure, while formal institutions (such as governments or utility companies) manage the bulk and link infrastructure. Finance must be appropriate - for example, microloans for household-scale sanitation improvements.

- At the project level, the economic benefits of improved water and sanitation can be substantial. Reductions in time (especially of women) spent every day to fetch water, and in household expenditures on purchasing water, are some obvious benefits.

  Accompanying declines in incidence of water-related sicknesses and diseases can free scarce public resources for alternative uses. Improving the physical environment in and around the home could also motivate residents to clean, beautify and upgrade their immediate neighbourhoods.

- In most urban centres, it is the poorer groups that face the most serious environmental hazards and have the least possibility of avoiding them or receiving treatment to limit their health impact.

- There is a need for integration of water and sanitation with other efforts to reach the same project objectives. Thus water and sanitation must be integrated with the provision of solid waste disposal, roads, stormwater drainage, flood prevention, education in water and sanitation use, primary health care, education in general health care, shelter upgrading, nutrition improvements and opportunities for earning income (this list is not exhaustive).

- People demand, and are willing to pay for, a progression of environmental services as they move up the socio-economic ladder. For example, in respect of water and sanitation services and related efforts:

  - The first environmental priority of a dweller in an informal settlement is to secure an adequate water supply at reasonable cost. The demand is for quantity of water, as in assurance of supply, and not having to walk too far to fetch it. This is soon followed by the demand to secure a private, convenient, and sanitary place for defecation.

  - Success in meeting these primary needs gives rise to a second generation of demands. One example is for removal of wastewater from the household, then from the neighbourhood, and finally from the city. Another example is that the **quantity** of water supplied being satisfactory, the demand grows for improved **quality**.

  - Success in this gives rise to yet a third generation of demands: for the protection of the green environment, inter alia from the degrading effects of large amounts of waterborne waste.

- Governments tend to base their expenditure on water and sanitation on political and social considerations rather than on purely economic criteria. In many countries, this has led to heavy dependence on centralised command and control. The result has often (but by no means always) been unreliable projects that produce services that do not meet consumers' needs and for which they are unwilling to pay. The absence of financial discipline and accountability for performance, along with political interference in decisions about allocations and pricing, are reflected in a litany of problems that often include: inefficient operations, inadequate maintenance, financial losses, and unreliable service delivery.

- Disparity in access is generally aggravated by subsidies being applied in an insufficiently discriminating manner. As a result, many subsidies on water or sanitation service do not reach the lower-income groups for which they are intended.

Moreover, where such subsidies take the shape of water and sanitation provision at price levels below provision costs, the financial sustainability of the system is placed at risk. This adversely affects network extension into areas presently unserved or not adequately served, as well as the operation and maintenance of the existing network.

- While not denying the importance of equity and the need to provide all people with basic water and sanitation, a recent emphasis of the international agencies has been on closer consideration of cost and price issues, of affordability and willingness to pay, and of incentives both for performance by providers and for efficiency by users.

- Essential elements in the above are an efficient billing and revenue collection system, the regular uprating of tariffs, and the penalising of defaulters - together with an efficient and equitable welfare support system for the very poor.

Thus, while the performance of the water and sanitation sector in many developing countries remains less than satisfactory, cumulative experience has led to the following broad consensus, among most international agencies active in the sector, concerning key aspects of water and sanitation development:

- The fundamental environmental problems facing poor communities in both urban and rural areas are with few exceptions directly related to water and sanitation.

- Responsiveness to people's demand must be the basic determinant in programme and project design.

- Water must be treated as a commodity with an economic value, not as a free resource.

- Community participation is an essential ingredient for effective implementation and sustainability.

- Institutional reform, including decentralising management to the lowest appropriate level, is usually a prerequisite to tangible sectoral progress.

Much has been learned, from case studies, about what works in given sets of circumstances and what does not, and why. Clearly, projects and programmes must be tailored to, and evolve from, diverse individual and dynamic circumstances. And there is a broad recognition that the existing knowledge gap relating to "best practices" and an "enabling environment" must be addressed more rigorously to move from rhetoric to reality, and from policies to practice.

CONTENTS

LIST OF BOXES

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CBO	:	community-based organisation
CHF	:	(Honduras) Cooperative Housing Foundation
DLA	:	(South Africa) Department of Land Affairs
EHP	:	(United States) Environmental Health Project
EMOS	:	(Chile) Empresa Metropolitana de Obras Sanitarias
ERR	:	Economic Rate of Return
GDP	:	gross domestic product
GIS	:	Geographic Information System
KDA	:	Karachi Development Authority
KPI	:	Key Performance Indicators
MIT	:	Massachusetts Institute of Technology
NGO	:	non-governmental organisation
OPP	:	Orangi Pilot Project
PROWWESS	:	Promotion of the Role of Women in Water and Environmental Sanitation Services (of UNDP)
PSP	:	private sector participation
RDP	:	(South Africa) Reconstruction and Development Programme
RTI	:	Research Triangle Institute
SAICE	:	South African Institution of Civil Engineers
SAITRP	:	South African Institute of Town and Regional Planners
TMC	:	Transitional Metropolitan Council
UK	:	United Kingdom
UMP	:	Urban Management Programme (of UNCHS/World Bank/UNDP)
UNCHS	:	United Nations Centre for Human Settlements (Habitat)
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Childrens Fund
USA	:	United States of America
USAID	:	United States Agency for International Development
USHUD	:	(United States) Department of Housing and Urban Development
VIP	:	Ventilated Improved Pit (latrine)
WASH	:	(United States) Water and Sanitation for Health Project
WEDC	:	Water, Engineering and Development Centre (of Loughborough University of Technology, Leicestershire, UK)

1. INTRODUCTION

This report has been written in terms of a letter of appointment dated 1994-07-12. To quote:

"The main aim of the research is to collate data on World Bank experience of greatest value to the water and sanitation initiatives currently gaining momentum in RSA in terms of the Reconstruction and Development Programme (RDP) and on other aspects as listed in the annexure [attached to the letter].

Sources of information will be World Bank publications and internal documents and, more importantly, discussions with the authors of these publications and in particular with staff of the Water and Sanitation Division and the UNDP - World Bank Water & Sanitation Programme. Staff of the Water & Sanitation for Health Project will also be consulted.

These discussions need not be restricted to water and sanitation alone."

The focus of the report is on the following aspects of the "enormous body of very relevant experience that [the writer was] able to tap into at the World Bank":

- willingness to pay for water and sanitation infrastructure
- how to overcome cultures of non-payment for infrastructure
- the role and influence of municipal government (as opposed to other forms of service provider or service regulator), and its acceptability or not as a government
- indicators of the effectiveness of infrastructure
- shared vision (or the lack thereof) of roleplayers, and the expectations of some
- issues of demography and urban development
- issues of the economy (macro and micro), and economics
- financial issues
- institutional issues
- resource limitations, and means of optimising the use of scarce resources
- technical, institutional, financial and socio-economic options for infrastructure provision
- in respect of all the above: identify assets, constraints, barriers or opportunities.

The above list of aspects, adapted from Section 2 of the annexure to the 1994-07-12 letter, is in this report added to and re-sorted in order to best enable a comprehensive overview of the knowledge and experience that the World Bank (principally) and other USA-based agencies concerned with developing countries can bring to the provision of water and sanitation in South Africa.

The emphasis is almost exclusively on urban and peri-urban, rather than rural areas, because -

- this is the writer's primary interest
- the interest of the World Bank and the other agencies, having previously had a rural emphasis, during the 1980s swung to the urban areas.

The latter is for several reasons that are set out at length by the Bank : for example -

- "urban economic activities making up an increasing share of GDP in all countries ...."
- "even if poverty is still largely rural in many countries, ... urban poverty will become the most significant and politically explosive problem in the next century ...."
- "with urban poverty increasing, the productivity of the urban poor should be enhanced by increasing the demand for labor and improving access to basic infrastructure and social services ...."
- "more attention should be devoted to reversing the deterioration of the urban environment". (World Bank 1991, pp 3 & 4.)

2. OBJECTIVE OF THE REPORT

The objective of this report is thus to discover, and comment on, experience in other nations in water and sanitation provision that could be appropriate to the developing urban and peri-urban areas of South Africa.

The emphasis is on case studies documented by and current thinking in international agencies: particularly the World Bank, and the UNDP - World Bank Water and Sanitation Programme, but also the Environmental Health Project (formely the Water and Sanitation for Health Project) and others.

This objective is achieved as follows:-

- introduce the concerns reported by international agencies: Chapter 4
- describe and examine experience in water consumption and sanitation technologies: Chapter 5
- describe and examine experience in institutional, legislative and financial issues : Chapter 6
- describe and examine experience in economic issues: Chapter 7
- describe and examine experience in environmental and social issues: Chapter 8
- describe and examine experience in cost, price and affordability issues: Chapter 9
- overview and summarise approaches and experience: Chapter 10.

Conclusions are drawn in Chapter 11.

This division into chapters is for convenience in assembling the information. However, the issues are not separated, least of all in the measures that will best address problems and opportunities. Indeed, the issues are greatly interwoven - Section 4.3 goes to considerable trouble to substantiate the holistic nature of issues and responses. Therefore there is considerable overlap from chapter to chapter. Concerns and ideas introduced in one context are frequently revisited in another chapter, albeit with a different slant to them.

3. SOURCING

3.1 The sabbatical

The report has been written by Kevin Wall, Consultant to Ninham Shand Inc, who spent a sabbatical year 1993/1994 in the United States of America (USA), with visits to the United Kingdom (UK) and Jamaica, studying urban issues. Principal among these issues was water and sanitation for developing countries. For this he conducted research at USA-based organisations active in developing countries.

The sabbatical experience consisted of discussions, interviews, courses and conferences and literature review.

Substantial time was spent with the USA-based organisations in the forefront of water and sanitation research and practice for developing countries, principally (Box 3.1) -

- the Centre for International Development of the Research Triangle Institute (RTI), North Carolina
- the University of North Carolina at Chapel Hill
- the World Bank, and in particular: the Water and Sanitation Division of the Transportation, Water and Urban Development Department; the UNDP - World Bank Water and Sanitation Programme; and the UNDP/UNCHS/World Bank Urban Management Programme.
- the US Agency for International Development (USAID) Office of Housing and Urban Programs
- the Environmental Health Project (formerly the Water and Sanitation for Health Project)
- the Urban Institute
- several prominent consultants.

However, the report by no means consists solely of material gathered on the sabbatical. In the more than a year that has passed since his return from the sabbatical, the writer has kept up to date with published material on the subject, and has discussed the subject with those au fait with latest international experience.

3.2 Selected knowledge

These Chapters 4 through 9 comprise a selected summary of the writer's knowledge of water and sanitation in developing countries as learned during the above-mentioned sabbatical, and subsequent to his return home.

It is selected in the sense that, in the light of the writer's knowledge of South African needs and circumstance, emphasis is in this report placed on the most promising knowledge. For example, what (in various studies) were identified as the most effective water and sanitation technologies, or the most effective means to prevent free ridership, and what were their generic drawbacks, or the local contextual factors that contributed to their success?

Leitmann (World Bank, personal communication, 1994) stressed the need for dissemination of "national and international examples of good practice" in services (and in urban management and housing finance). He stated that he regarded this dissemination to be one of three short-term needs for South African urban practitioners, the other two relating to the establishment of local government and to the importance of local RDPs.

Whereas in the past the World Bank has drawn generic conclusions from its various projects, the end result of these has sometimes been a set of guidelines, which can be and sometimes are interpreted as being universal panaceas. The subtleties of the circumstances of each particular case are lost in this generalisation process. The now preferred approach of the World Bank is to draw the case studies themselves. The difference in philosophies is between "you have to do this or that" and "we tried A in circumstances B - draw the lessons for yourself if you feel that your circumstances are analogous to B." (Roome, World Bank, personal communication, 1994.) Thus, in many instances in this report, the same approach is followed. To further capture the subtleties of each particular case, use is sometimes made of extended quotations from publications.

Also illustrating the shift from generic guidelines, Briscoe argued against "normative positions" on "both technologies and institutions", and instead in favour of a "structured learning" approach, in which basic principles are defined, innovation stimulated, and mechanisms devised for feeding back the lessons of experience." (World Bank 1994, p38)

This "structured learning" approach is well under way. For instance, in Brazil, the World Bank-financed Prosanear project (Box 3.2) "..... provides a framework and resources for municipalities and utilities to experiment with innovative technical and institutional arrangements for providing sanitation services to the urban poor. Subprojects are approved only when they meet the broad guidelines, which require evidence that they have digested the lessons of experience and that the arrangements take account of the incentives facing different stakeholders." (Briscoe 1993, p35)

The difficulty in writing a report such as this is to exercise discretion in the selection of material. In order to write this report, a very large number of publications were reviewed, as was the great volume of information received during interviews etc. of the sabbatical. The art lay in abstracting ideas from or selecting passages from those publications or interviews that appeared to best contain information of relevance to South African needs. In order that material not included is not lost, the list of references is extensive, and, furthermore specific reference is made at various places in the text as to where additional published material may be found.

Box 3.1: Selected USA-based organisations in the forefront of water and sanitation

3.1.1 The Center for International Development, Research Triangle Institute

The Center for International Development at Research Triangle Institute provides research, technical assistance, and training to promote sustainable economic, technical and social development and understanding. The Center stresses action-oriented results to help increase the capacity of host country institutions to develop and implement policies that support broad-based development. Technical work is centred in four programme areas, viz -

- policy support systems
- social services and human resources development
- urban / regional finance and management
- environmental and natural resources.

3.1.2 World Bank: Water and Sanitation Division

The Water and Sanitation Division was established in 1993 as a separate division of the Transportation, Water and Urban Development Department. Although it and the UNDP-World Bank Water and Sanitation Programme. "..... have complementary mandates, the basis for the Division's policy and research work is derived from cross-support activities to the Regions. Applied research, through "structured learning" from cross-support, is providing new insights into how to resolve critical issues in the Division's three primary areas of focus: water resource management; utility reform and restructuring; and informal institutions.

In water resources, most of the attention is devoted to implementation of the principles of the Bank's Water Policy Paper, namely, management of water resources as an economic good, management at the lowest appropriate level, and ensuring effective stakeholder participation in the development of management strategies and decision-making. The structured learning approach is currently being applied in major cross-support activities [in various countries].

The Division's work on utility reform and restructuring focuses on issues related to the institutional and regulatory setting, mechanisms for redefining public and private sector roles and encouraging more private sector involvement where appropriate, and promoting a more commercial orientation in public and private utilities.....

With respect to informal institutions, the Division has been concerned with knowing more about how they can serve as an effective complement to (or substitute for) formal sector organizations. It has played a major role in development and 'strategic supervision' of innovative projects involving informal institutions in Indonesia and Brazil." (World Bank 1993, p34)

3.1.3 UNDP - World Bank Water and Sanitation Program

"The UNDP - World Bank Water and Sanitation Program is a collaborative initiative emerging from the International Drinking Water Supply and Sanitation Decade of the 1980s. Concentrating work on a dozen focus countries and operational in more than 30 other developing countries, Program activities serve to strengthen national and local efforts for improving the access of poor people to safe water and sanitation.

continued

To carry out this work, the Program relies on the expertise of a global network of staff stationed in four Regional Water and Sanitation Groups and within country-level projects. This field team is backed by a management group in the World Bank's Water and Sanitation Division in Washington, DC. .... Close integration of the [Division's] work plan with that of the Program provides additional capacity to meet strategic objectives.....

The goal of the Program in the 1990s remains... to assist developing countries in improving poor people's access to sustainable services. By acting as a catalyst in bringing innovative approaches into the mainstream of sector development, the Program aims to attain this objective on a large scale. This process will require concerted efforts to learn systematically from ongoing activities." (UNDP - World Bank 1992, pp 3&4)

3.1.4 Urban Management Programme of the United Nations Development Programme, the World Bank, and the United Nations Centre for Human Settlements (Habitat)

The World Bank, the United Nations Development Programme (UNDP), and the United Nations Centre for Human Settlements (UNCHS) have joined forces with the donor community and developing countries in a co-operative Urban Management Programme (UMP). UMP's aim is to develop and promote appropriate policies and tools for urban environmental management, land management, infrastructure development, municipal finance and administration, and poverty reduction. The UMP stresses capacity building through a partnership with national, regional and global networks and with donors in applied research and the disseminiation of information and on the best practices and promising solutions from experience.

"The UMP is a long-term technical assistance programme designed to strengthen the contribution that cities and towns in developing countries make toward human development, including economic growth, social development, and the reduction of poverty...

UMP Phase 1 (1986-92) involved research and development of policy frameworks, discussion papers, and management tools of a general nature. UMP Phase 2 (1992-96) is translating these results into operational support for policy reforms, planning, and programming at the national, regional and city levels.....

Beyond 1996, there will be a need to complete the process of institutionally anchoring the regional assistance networks. Satisfactory completion of this process will ensure the sustainability of the decentralised programme." (UNDP-World Bank 1994, p6)

3.1.5 US Agency for International Development: Office of Housing and Urban Programs

"The Office of Housing and Urban Programs works with developing nations around the world to respond to the housing needs of low-income urban families and to meet a range of other challenges associated with rapid urbanization. The policies of the Office are based on the belief that properly-managed urbanisation can help meet the problems arising from rapid growth as well as stimulate the economy, maintain a healthy living environment, and help house and provide basic urban services for growing populations.

continued

The Office emphasises urban policy reform in three interrelated areas:

- Shelter
- Urban Environment, and
- Municipal Management.

Housing and urban development contribute directly to economic growth through capital formation and employment generation and have a strong impact on the local and national economy. Proper management of the urban environment is mandatory for sustainable growth and quality of life.

USAID urban assistance works to strengthen the capacity of local governments to manage resources effectively and supports decentralisation and democratization initiatives worldwide. In all three focus areas, the Office promotes reliance on individual initiative, market forces, and the efficiency of the private sector to deliver urban services and to finance and produce shelter within sensible government policies to ensure equitable and broad-based participation.....

[In addition to the benefits that it brings], the growth of urban areas does present enormous challenges, especially to developing countries with severely limited budgets. The environment will only suffer if these urban problems are not addressed within their proper developmental context. Environmental quality in rapidly-growing areas is thus really a matter of choice. Management, not chance, is the determining factor in whether urban growth will help or harm the environment.

Environmental protection is ultimately an investment in the sustainability of the economy. It increases the number of people, the amount of economic activity, and the standard of living that a region can support". (USAID 1993, pp 3&15)

3.1.6 Environmental Health Project

Formed in 1994, the Environmental Health Project (EHP) absorbed the Water and Sanitation for Health (WASH) project, and several smaller environmental health-related projects, all sponsored by USAID. The EHP was initiated by USAID in response to the growing health problems created by environmental pollution and degradation. It provides technical assistance in speciality areas of environmental health, with a focus on helping to reduce mortality and morbidity caused by diarrheal diseases, malaria, and acute respiratory infection, i.e. the three environment-related diseases that place the greatest health burden on developing countries.

The purpose of this reorganization was to create a more "integrated and interdisciplinary" team that will enable USAID "... to demonstrate and act on the links that exist between the various areas, instead of supporting separate vertical programs. For example, USAID can consider such connections as the tropical disease implications of inappropriate water resource designs, the impact of inadequate solid waste disposal and poor wastewater handling on vector-borne diseases, and the effect of individual and community sanitation on food hygiene." (Environmental Health Project 1994)

"Prime contractor" is Camp Dresser and McKee International Inc, and one of the five "core subcontractors" is the Research Triangle Institute.

Box 3.2 Structured learning: Brazil's Prosanear Project

Brazil is one of the most sophisticated developing countries in terms of employing a wide range of technologies and service delivery approaches for periurban sanitation. Despite such extensive experience, Brazilian officials knew they could not simply "scale up" using a single proven technology or delivery mode. Instead they are using the $200 million World Bank-financed water supply and waste disposal project, Prosanear, as an experimental programme to test alternatives systematically. An initial technical assistance component managed by Brazilians and assisted by the World Bank has been designed to monitor the effectiveness of, and systematically learn from, a variety of sanitation technologies and service delivery mechanism, and to develop guidelines for project implementation and feedback.

The project is important not only because it will bring improved services to many low-income families but also because it initiates a radically different process of providing services. The key elements are fostering technical and institutional innovations; monitoring and evaluating processes and outcomes so that adjustments can be made rapidly both within subprojects and across projects as successes and failures emerge; and breaking the master plan/blueprint mould while providing a precedent for similar approaches in other developing countries.

The diverse range of subprojects carried out by Prosanear provides an opportunity for further testing of a range of technologies. A monitoring exercise is documenting types of technology and design criteria, cost estimates, selection basis, and requirements for operation and maintenance. World Bank participation is also facilitating evaluation of alternative service delivery options, including the potential for service contracts with the private sector and for community management and participation. The Brazilian technical assistance unit is carefully documenting the performance of sanitation technologies and institutional arrangements in various locations throughout Brazil. By the conclusion of the technical assistance component of Prosanear, Brazil will have:

- Objective documentation of the performance of periurban sanitation experiences, and an assessment of why they were successful or unsuccessful;
- Experience with a range of sanitation technologies and delivery mechanisms;
- The informational basis for planning additional large-scale investments employing a range of technologies and delivery systems moulded to local needs and conditions; and
- Increased capacity and experience at various levels - national government, state water companies, municipalities, NGOs, and communities - in testing approaches, monitoring their experience, and adapting these to fit their requirements.

World Bank participation will ensure that documented lessons from this project experience will be widely available for others undertaking projects to improve periurban sanitation.

(UNDP-World Bank 1992, p6; Mejia et al 1993; Briscoe 1993, p36; Briscoe, World Bank, pers comm, 1994)

4. THE CONCERNS OF INTERNATIONAL AGENCIES

4.1 Introduction to infrastructure provision

"Behind today's urban sanitary crisis in the developing world are twin phenomena - rapid population growth and rapid urbanisation - occurring simultaneously in countries which are poor. Rapid population growth is, ironically, the result of improvements in public health and disease control. Rapid urbanisation is the outcome of deteriorating livelihoods on the land and the magnet of urban jobs and economic opportunity - a magnet drawing in all classes of people but especially the poor. Together, these phenomena have ignited an urban demographic explosion. Since it takes time for people to adapt their intimate behaviour to the constrictions of urban life, typical rural newcomers to the slums and shantytowns of the Third World initially tend to maintain their prevailing high birth rates. This accelerates urban population growth, of which 61% is among existing inhabitants.....

Such a rate of growth would stretch urban planners, architects, engineers and civic administrations to the very limit even if resources were plentiful. But in many countries, particularly in Africa and South Asia, resources are very few. They are often constrained by the same forces - low agricultural prices, debt, economic depression, flood or drought disasters - [that are] driving people off the land. Towns and cities are finding it very difficult to cope.

Many of the newcomers fetch up in settlements where municipal investment in services - roads, water supplies, drainage - is negligible or non-existent. The proportion of "urban poor" in many cities is between 30% and 60%, and in some is spectacular: in Addis Ababa, 79%; in Luanda, 70%; in Calcutta, 67%. And the population growth rate in slums is higher than in virtually any other environment in the world; it may be - as in Bangladesh - four times the rate of a country's population as a whole. By 2000, the numbers of those living in what are variously described as *favelas, barrios, bastis* and *bidonvilles* will be well over one billion worldwide." (Black 1994, pp 6 & 7.)

"The huge numbers of people living in towns and cities, and the increasing proportion living in slums, will present the 21st century with its most important environmental health challenge. Some cities in the developing world are already facing critical environmental degradation. This is a result of overload on water sources, improper waste disposal, contamination of rivers and streams, the reckless extraction of water from depleted aquifers, and a long list of service management deficiencies. Water boards and public utilities fight a losing battle to provide a functioning service in the face of increasing demand; as the quantity of available water dwindles and the quality declines, disruptions - even sabotage - of existing systems become more acute. A vicious circle develops in which the service is so poor that it cannot recover its costs from users; and the income generated so low that the service cannot be improved.

.... Water is a commodity like any other, and its price is soaring. But in developing countries there is a marked reluctance to come to terms with water costs. Urban consumers in most industrialised countries pay all the recurrent costs for their water supplies and sewerage connections. In developing countries, however, those provided with services pay far less: on average only 35% of the costs, according to the World Bank. The proportion of investment generated internally by utilities and water boards is also dropping, and their financial situation is therefore consistently worsening.

.... The task of responding to the backlog of demand *and* to the expanding settlements of new urban dwellers becomes more difficult every year, especially as the extra strain on many existing systems leaves them in constant need of repair.

Other dynamics are at work. Where incomes and standards of living rise, per capita water consumption similarly shoots up. This places more pressure both on the water supply and on the system delivering it. Increased usage also generates a larger volume of waste [wastewater]. The growing outflush of dirty water has major environmental implications; but drainage and water treatment are frequently ignored by urban development planners, as is solid waste disposal. In Latin America, no more than 2% of human waste is treated - it is simply washed into waterways." (Black 1994, pp7-9)

Infrastructure provision in the urban areas of developing countries, in recent times always inadequate, has fallen far behind need. This is for a number of very much interrelated reasons that are discussed in this report, but the following are most important -

- rapid growth of the urban areas
- poverty of the nation and of the people, and thus inability to fund the infrastructure needed
- unsuitable policies in land use, transportation, city management, and other sectors
- unsuitable or under-resourced institutions.

No one of these reasons alone has been responsible for the woeful infrastructure inadequacies of a nation. For example, countries such as Japan, Korea and Taiwan have experienced rapid city growth, but this has been "sustained by an unusually stable institutional framework" and this urban infrastructure has by and large kept pace, thanks to "consistent and massive capital investment" and high standard operation and maintenance of the infrastructure. (Shluger 1995, p11)

The following statistics of "the ratio of total expenditures (maintenance, operations, capital) by all levels of government in infrastructure services (roads, sewerage, drainage, water supply, electricity, garbage collection) during 1990 and to the urban population" illustrate the point (in US$ per capita per annum) -

- Sub-Saharan Africa $15
- South Asia $15
- Latin America $30

- East Asia $48 (Beijing $44, Manila $45, Bangkok $101)
- industrialised countries $656 (Paris $920, Tokyo $1775). (USAID 1994b, p3: Shluger 1995 pp11&12)

The remainder of this chapter overviews the concerns reported by international agencies, particularly those concerns that -

- are seen to define the parameters of a water and sanitation effort (indeed, the parameters of an infrastructure programme), and
- are seen to demonstrate the holistic context of water and sanitation.

4.2 Parameters of an infrastructure programme

Infrastructure provision, particularly in the water supply and sanitation sector, faces two great challenges in developing countries.

The first challenge is to complete the "old agenda" of providing services. Although considerable progress has been made, much remains to be done. A thousand million people still lack access to an adequate supply of water, and 1700 million do not have adequate sanitation facilities.

Despite the number of urban people with adequate facilities increasing by about 50 per cent between 1980 and 1990, because of growth in urban population the number without access to adequate sanitation actually increased by about 70 million! (Serageldin, 1994, p3).

Furthermore, the quality and reliability of existing services are often unacceptable. To compound the situation, the costs of providing services are rising substantially because of rapid urbanisation, mis-management of water resources, and the low efficiency of many water supply organisations.

Over the past thirty years developing countries have allocated an increasing share of their gross domestic product (GDP) to public spending on the provision of local domestic (i.e. for residential areas) water and sanitation services. It would appear that the proportion of public spending on these local services has been too high and has not been appropriate, for three reasons: Firstly, the low contributions of domestic users have meant that supply agencies have not felt obliged to provide an adequate service, and to provide it to all consumers; in a sense, they have felt that they are not accountable to consumers. Secondly, this spending has been used primarily to provide subsidised domestic services to the middle and upper classes. Thirdly, spending on domestic services has left few public resources available for wastewater treatment and management at the wider urban or metropolitan scale. (Clarifying note: It is not that the amount of public spending is not warranted. It is that -

- there has not been the appropriate complementary private spending
- there has not been the appropriate public spending on complementary services
- much of the public spending has been mis-directed.)

The second challenge is the "new agenda" of environmentally sustainable development. In some respects, viz high costs and limited resources, the situation confronting developing countries is similar to that faced by industrial countries. But in other respects the task for developing countries is considerably more difficult. Water in developing countries is much more seriously degraded and is deteriorating rapidly; far fewer financial resources are available for environmental protection; and institutional capacity is weaker.

These themes are developed in more detail in the chapters that follow.

Thus not only the products of infrastructure, but also the processes of infrastructure provision, and the context of infrastructure, must be considered if basic needs are to be met (i.e. completing the old agenda) and also if the new agenda is to be addressed.

The UNCHS / World Bank / UNDP Urban Management Programme (UMP) identified the following products and processes as those generally of primary concern in developing countries. These could also define the parameters of any South African programme for meeting basic infrastructure needs.

- "Revisions to municipal regulatory frameworks to make them more responsive to the requirements of the poor, particularly with regard to housing, building and infrastructure standards, land tenure regularisation, ...

- Basic services delivery, particularly primary health care and primary education, micro-infrastructure in low-income neighbourhoods, water supply, solid waste management and sanitation; and

- Direct employment creation strategies through public works programmes, vocational education and other means" (UNCHS et al 1994, pp10 and 12).

The UMP went on to state that:

"The traditional supply orientation to infrastructure policy has tended to produce an overemphasis on facilities rather than a focus on services, emphasis on public sector provision (which requires the co-ordination of many institutional actors), and excessive involvement of political decision making regarding types of investments and pricing of services.

These developments, in turn, have resulted in inadequate operations and maintenance, non-sustainability and unreliability of services, constraints to economic productivity, and environmental degradation. The principal thrust of [urban infrastructure management] therefore, is to promote an urban infrastructure policy that -

- focuses on effective demand and
- emphasizes affordability, reliability, efficiency, competition, and appropriate standards, pricing for cost recovery and demand management, targeting of subsidies, and the involvement of the private sector ....

[UMP] confirmed that the "brown agenda" - water, sanitation, drainage, solid waste, and emissions - is the most appropriate context for urban environmental management [in developing countries]. ..... UMP has identified a wide range of underlying causes for urban environmental degradation and the resulting costs to public health and urban productivity, including: inappropriate economic policies; inadequate investment in urban infrastructure and services; inadequate cost recovery; weak management capacities; deficient regulatory and institutional frameworks; insufficient public awareness; and insufficient political will." (UNCHS et al 1994, p12)

Clearly, all of these need to be addressed.

Thus water and sanitation must be seen in terms of a provision for basic needs that is more than simply providing engineering infrastructure and other services.

The World Bank has identified the necessity for urban management programmes to meet basic needs by means that include the following (only one of which is infrastructural):

"• Increasing social-sector expenditure for human-resource development of the urban poor by providing basic services in education, health, nutrition, family planning, and vocational training.

• Increasing the access of the poor to infrastructure and housing to meet their basic needs.

• Recognising and supporting the efforts of the poor to meet their own needs through community initiatives and local, nongovernmental organisations.

• Targeted "safety net" assistance to those most vulnerable to short-term shocks, such as children and women who head households, through, [for example] direct transfers in food assistance, health care, employment, and provision of other basic needs on a short-term basis." (World Bank 1991, p55 and also pp68 to 72.)

Briefly, and focusing more directly on measures to enable water and sanitation infrastructure, "two central elements" can be discerned, viz:

"• *Institutions.* The promising institutional arrangements are ones in which the people who are affected are put in charge of decisions regarding both environmental services and the resources to be spent on them. At the lowest level this means letting households choose the service they want and are willing to pay for. At the highest level it means that the stakeholders in a river basin decide what level of environmental quality they want and are willing to pay for. Consistent with this participatory thrust is the dictum that decision making responsibility should be moved to the lowest appropriate level. Thus, for instance, river basin authorities should concentrate on managing abstraction (the removal of water from a shared source) and pollution externalities, and let municipalities decide how to manage their water and sewerage services most effectively. This inevitably means a more sharply defined role for the government and broader participation of the private sector and non-governmental organisations.

• *Instruments.* The other central element is to make more extensive use of market-like instruments at all levels. At the household level this means greater reliance on user charges for raising revenues and enhancing accountability and efficiency. At the service level it means greater reliance on the private sector for provision. And at the river basin level it means greater use of abstraction charges, pollution charges, and water markets for resource management." (Serageldin 1994, p2)

"Experience of the past decade confirms that the solution to [service] problems is not merely to expand capacity by making new investments. Much more systematic changes must be undertaken if service delivery is to attain the standards necessary to improve quality of life and allow economic output to expand more rapidly." (Fox 1994, p1)

"..... "watering and housing" the poor has not solved the problem of urban poverty. To alleviate urban poverty requires managing both economic as well as social aspects of poverty. The objective of urban programmes and projects must be to enter the city not just through "the house and bathroom" but through interrelationship between economically, environmentally and socially sustainable urban development. This includes interventions in basic services in education, health, nutrition and family planning as well as increasing access to infrastructure and housing. It requires the integration of institutional structures other than local government, as well as the development of more participatory planning procedures." (Moser 1993, pp2 and 3)

Thus, whereas consideration of alternative technologies is still important, the attention of the World Bank has long shifted to consideration of technology in a more holistic (embracing also financial, economic, political and institutional) context.

Finally, the World Bank has pointed out the extent to which services infrastructure is important to the economic activity of a city. "Urban economic activity depends on infrastructure such as power, roads and water supply. Similarly, the health of urban populations living in high densities is dependent on sanitation and clean water supplies. Some activities, such as urban transport, are particularly complex because of their effect on settlement patterns and congestion and the high cost often involved. Failures of public management and scarcity of financial and technical capacity have resulted in widespread deficiencies in water supply, electricity, transportation, communications and solid waste management. These deficiencies impose heavy burdens on the productive activity of urban households and enterprises. Firms in Lagos, for example, must provide their own electric power. Traffic congestion in Bangkok, Cairo and Mexico City impede the movement of goods and services and thus reduce the economies of agglomeration or urban markets. Communications are also lacking in many cities: in Sao Paulo there are twice as many cars as telephones. Unreliable sources of water constrain manufacturing processes in Karachi and Lima." (World Bank 1991, pp36, 37, 38)

The implications of service failure can be felt throughout developing countries. "Low income people often are most affected because they have the fewest acceptable options and are least likely to obtain alternative services. Business production costs rise substantially as firms content with inadequate infrastructure services or install their own captive capacity. Small and newly starting firms, the source of many new jobs, will be the most disadvantaged, and their inability to succeed can substantially inhibit overall economic performance. Other consequences of poor service delivery include congestion, environmental degradation, and poor health conditions." (Fox 1994, p1)

4.3 The holistic context of water and sanitation

Thus, ideally, narrowly-focused investments must be preceded by holistic policy-setting, and then be part of a broad package of interventions in any community.

Consider : The authorities, or the community, based on a narrow view of the available options, decide that suburb A needs sanitation, indeed waterborne sanitation to each plot, above all else. Therefore this is provided.

It could be that this is what is needed, and that the people can afford to pay for (and do pay for) the infrastructure.

It could also be that the people are just as unhealthy five years later, that they are for reasons other than political protest not paying their water and sanitation charges, and that water and sewage are flowing in the streets.

What might underlie this latter ? What were the authorities and the community trying to do ? Was it to provide waterborne sanitation ? Or was it to provide, simply, sanitation ? Or was it to enable the people to be more healthy ?

If "more health" was the objective, then sanitation is only one of a set of more-or-less interrelated measures towards achieving this objective. These include interventions in the focused issues of -

- water
- exterior air pollution (e.g. dust, vehicle emissions, industrial emissions, coal and wood smoke); combatted by inter alia electrification of suburb A
- interior air pollution (e.g. dwellings that are overcrowded and/or underventilated and contain coal/wood/paraffin stoves)
- home hazards (e.g. structural instability, open stoves, electrical appliances, dampness)
- solid waste
- nutrition
- inadequate knowledge of how to buy best value (e.g. food) for the household's limited money
- poverty
- unemployment.

Provision of one or other of the above could be a more cost-effective way to improving health than provision of waterborne sanitation would be. And more sustainable, too.

Conversely, providing sanitation without addressing the other issues could leave the people no better off (maybe worse off) than before. The case study of Guatemala City's "precarious settlements" is evidence of this. (Box 4.1)

Furthermore, simply providing any or all of the above-listed measures to health is not going to work either, without the financial, economic, institutional, social, etc framework to back it up.

Table 4.1, "Critical policy links for urban environmental management", is extracted from a World Bank document. This table, part of a longer table, sketches an interrelationship between issues, causes and reforms, and highlights that -

- the issue may apparently be technological/physical
- but the main causes and the primary areas of needed reforms are financial/economic/institutional/social !

TABLE 4.1 CRITICAL POLICY LINKS FOR URBAN ENVIRONMENTAL MANAGEMENT

MANAGEMENT ISSUE	UNDERLYING CAUSES	RELEVANT POLICY REFORMS
Serviced land and shelter	• Badly functioning urban land and housing markets • Highly regulated prices • Lack of affordable housing for the poor	• Reform property rights • Develop mortgage financing • Introduce affordable standards, and target subsidies to the poor • Reduce unneeded regulations, government interventions and subsidies
Water, sanitation, drainage, solid wastes, transport	• Supply side dominated by monopoly (government or major utility agency) • Prices heavily regulated • Heavy subsidies for the "few"	• Reduce subsidies; and spread them more • Move toward decentralization, privatization, local participation • Introduce pricing and demand management • Design to, through self-interest, reinforce incentives

(Bartone et al 1994, p39)

It is easy to understand why so often interventions are narrowly focused. For example:

- There has seldom been understanding of the holistic nature of needs, and of the interrelationships of interventions.

- The majority of the practitioners (politicians, officials, consultants) believe they individually can intervene in only one aspect of the reconstruction and development at a time and not the whole. (They may not appreciate that they can do that piece better if they take a wider view of it, and see it in its context.)

- Politicians may prefer the narrow focus, especially if that of a physical development, because this deliverable has a better chance of becoming visible in the short term (i.e. before the next elections).

- Communities may regard the physical development as more desirable in that they are more likely to benefit from it, and sooner.

4.4 Chapter 4 conclusions

The conclusions are briefly, that-

- the "old agenda" of providing household services must be completed, but much remains to be done, and current effort is not even able to keep pace
- for water and sanitation to "succeed", the technology of water and sanitation must be supported by appropriate institutional, financial, etc. measures;
- water and sanitation is only one of several interventions, complementary towards the same broad objective of "more health", but only to a limited extent substitutable one for the other.

4.5 Notes on additional references

- The World Bank **Abstracts** contain summaries of two dozen papers on water and sanitation that reflect the current interest of the Bank's Water and Sanitation Division and the UNDP - World Bank Water and Sanitation Programme on particularly -
  - "informal institutions as effective complements to or substitutes for formal organisations in water and sanitation services;
  - utility reform emphasising institutional setting, redefining public and private sector roles, and encouraging both more private sector involvement, where appropriate, and a more commercial orientation", and
  - "in the area of informal institutions, ... the design and implementation of innovative projects, which incorporate a learning approach, and on the dissemination of lessons and best practices." (World Bank 1994, p iv)

- For general overviews of developing countries' urban environmental problems (both brown and green), environmental priorities and water and sanitation provision, see -
  - Parker 1992
  - Chapters 2 ("Environmental priorities for development") and 5 ("Sanitation and clean water") of World Bank Development Report 1992 (World Bank 1993a).

- For further case studies of urban problem areas in water and sanitation, see -
  - "Sanitation problems in Alexandria, Egypt", in Okun 1991, p18

Box 4.1: Guatemala City's "precarious settlements"

A case study of interest is reported from Guatemala City (Espinosa and Rivera 1994, pp9-30).

In this instance, health budgets had been "centred on curative rather than preventive services", but infant mortality among the one-third of the city's population that lived in "precarious settlements that lacked basic infrastructure and services" remained high.

Only in 1986 was a more "broad-based" approach adopted. The introduction of community health promoters ("reproinsas") enabled area surveys of the services available and secondly house-to-house surveys to discover specific health problems - for instance what the common illnesses were and what family habits were. Reproinsas were given training "geared largely towards prevention and detection". Much of their work "was awareness-raising and education" and encouragement of mothers to have their children vaccinated. Another area of their focus was nutrition. Pigs and chickens are raised. "Some of the livestock is consumed locally, increasing protein intake among the urban poor. Meanwhile, income from pigs and chickens sold outside the community goes to support *reproinsas* and to help cover costs. ..., this type of activity, while not overly profitable, is viewed by the co-ordinators of the programme as a means of improving nutrition and providing increased food security to residents of squatter settlements."

Espinosa and Rivera conclude that: "The basic methodology used in this *reproinsas* programme is likely to work well in other areas - although obviously adapted and modified to match local conditions and context. The key is that local residents must be viewed as the key actors, the subject of their own problems and not as objects for whom outside institutions must plan and do things. It is only when people become conscious of their problems that they can begin to effect positive changes in the conditions that surround them. Technical staff need to support the community groups but as facilitators. This is where the lines become difficult to draw. The support should not be total, to the point where the community is not really required to participate.

Over the course of the work with the *reproinsas*, through a process of discussion and reflection, the women with whom we have been working have defined four basic elements, without which a project cannot be successful:

- organisation on the part of the community;
- widespread community participation in the initiative;
- a project able to sustain itself, especially finding ways to cover costs; and
- there must be inter-institutional co-ordination, i.e. a working relationship with outside institutions capable of providing initial technical and financial support.

The lack of any one of these elements can easily lead to failure."

Furthermore, "the integrated nature of these initiatives is also important. As the *reproinsas* learnt during their training, health problems do not exist in isolation. They are intimately linked to the sanitary conditions prevailing in any area. The improvements in water and sanitation achieved [in a simultaneous programme] by the technical team played a major role in the fall in infant mortality rates. Prevention and education can only go so far if the underlying structures affecting health conditions - in this instance water supply and sanitation - are not changed." (Espinosa and Rivera 1994, pp9-17)

5. EXPERIENCE IN WATER AND SANITATION TECHNOLOGIES

5.1 Chapter 5 introduction

The literature on alternative technologies is vast, and even to summarise it in this report is simply not feasible.

In our own review of the literature, there is increasing evidence of acknowledgement that the non-technological setting in which the technology is placed is vital to the success of that technology; this is also apparent from increasing attention being given to this setting since the start of the 1990s.

It is also apparent that technology choice is, wittingly or (often) unwittingly, made in the context of a set of assumptions. These assumptions relate to (section numbers are those in which the assumption is explored more fully):

- (Section 5.2) How the technology (the water or sanitation alternative, and its detailed design and manufacture) will suit technological factors (conditions) that it is assumed will be found in practice. Examples of these conditions are -
  - geotechnical and groundwater conditions
  - type of housing and its density
  - frequency of use of the facility (for example: how many persons per facility, and how much of each day are they are using the facility?)

- (Section 5.3) How the facility will be constructed (i.e. workmanship). How the facility will be operated and maintained -
  - by the individual users
  - by the corporate agency (be it community, utility company, local government - whoever has the responsibility for the "public" part of the facility).

- Other elements upon which the success of technological alternatives are dependent - principally, assumptions as to institutional strength. enforcement of regulation, monitoring of use, penalising of abusers of the system, adequacy of funding for operation and maintenance, and so on. (These are covered in subsequent chapters.)

- (Section 5.4) Complementary services - principally -
  - if a water service is provided, will sanitation also be provided, or at least a means of dealing with sullage and vice versa

- will there be, together with provision of the sanitation "hardware", education in correct usage? And in general hygiene?

Thus Section 5.2 deals with the technology options, i.e. the alternatives available under various assumed sets of technological conditions, e.g. that if the soil is assumed to be X, it is X. However, the technology alternative that is chosen could also fail if the assumptions discussed in Section 5.3 or in Section 5.4 are incorrect at the time of decision-making, or alter at any time thereafter. For example, a technological alternative could be chosen on the assumption that the construction workmanship will be to a high specification and that regular maintenance of the facility will be carried out; however the technology could fail because one or more of these assumptions is in error to start with or changes over time. Box 5.1 provides evidence of failure in these assumptions. Section 5.5 briefly deals with resistance to what is perceived as "inferior technology".

5.2 Technological alternatives

Descriptions of the alternatives; and discussions of their relative merits, were almost all written during the 1980s. It is our impression that during that decade most of what could be said about the technologically-driven approach, was said. Subsequent publications tend only to either summarise the information, to discourse on refinements of the technology, or to describe case studies; with the exception of the publications of Bakalian (and Bakalian et al), they add little that is fundamental.

Some of the many references that describe alternative technologies are:

(i) Broader overviews include:
- Pickford 1990 (water and sanitation)
- Chapter 6 of Kerr 1990 (sanitation)
- Kerr 1989 (water)
- Chapter 5 (water) and Chapter 6 ("sanitation and sewerage") of Tayler and Cotton 1993.

(ii) More detailed references include:
- the benchmark World Bank "Appropriate technology for water supply and sanitation" series of the early 1980s, especially -
  - Kalbermatten et al 1980 (1980a, 1980b, 1980c and 1980d)
  - Golladay 1983
- Rybczynski et al 1982
- Otis and Mara 1985 (small bore sewers)

- Hebert and Ynigeuz 1986 (water)
- Okun and Ernst 1987 (water)
- Alosoroff et al 1987 (handpumps)
- Bartone 1990 (water and sanitation)
- Government of India 1992 (pour flush latrines)
- Franceys et al 1992 (on-site sanitation)
- Bakalian 1992 ("subdivided sewerage")
- Bakalian et al 1993 ("simplified sewerage")
- Blackett 1994 (on-site sanitation)
- Bakalian et al 1994 ("simplified sewerage").

A bibliography that is both recent and comprehensive in the field of technology is Franceys and Cotton (1993).

"Careful attention to design of services can bring housing and infrastructure within the range of affordability of low-income households in the growing cities of the low-income countries. Reductions in cost can be achieved when compared with a conventional sites and services scheme of between 14 per cent and 68 per cent. These figures are significant when multiplied by the number of households which need to be established.... . It is hoped that the ideas and information referenced in this bibliography will enable planners and engineers to find out what has worked on other parts of the world, and to limit the common practise of over-designing so that there can be a better matching of costs to the benefits while allowing the community the chance of upgrading at their own rate." (Franceys and Cotton 1993, p ii)

The suggestion that the water and sanitation facilities available to many urban people in developing countries could vastly be improved, and yet be affordable to them, as long as there is acceptance of lower standards and acceptance that alternatives such as waterborne sanitation are unsustainable, is promoted in a substantial number of studies. These alternatives can broadly be divided into two, not mutually exclusive, categories, viz -

- on-site alternatives
- communal alternatives.

As a single case study of each (from a wide choice in the literature):

"Over 1 200 households in Kumasi, Ghana were interviewed about their current sanitation practices, perceptions of existing sanitation conditions, expenditures, and their knowledge of improved sanitation options. The results of the survey and the related research revealed an appalling and, from a public

health perspective, dangerous situation. Households were generating about 25 000 cubic metres of waste per month, but only about 10 per cent of it was removed from the city. The remaining 90 per cent was left in the urban environment. ..... People in Kumasi were only spending about US$1.50 per capita annually for sanitation services, and, correspondingly, were getting very poor service. Households were quite open to the idea of simple, low cost, on-site solutions to their sanitation problems." (World-Bank 1994, p42, describing Whittington, Lauria et al 1993.)

Residents in one area of Guatemala City had installed "... a "corporate" or single source water tank in the neighbourhood. Such units are usually installed only on a temporary basis on construction sites or for large enterprises consuming high quantities of water. [However], from this single source, the community created a supply network to reach individual residences with UNICEF providing the funds for the pipes and other materials. Each family carried out the work necessary for their own home connection. The local community association receives one large bill from the water company and then collects fees from residents according to usage measured by individual metres. A resident chosen by the community was trained to manage billing and the collection of fees. Most of the fees are to cover actual costs but a portion is set aside for maintenance and the surplus will go towards other local infrastructure needs such as drains and sewers.

Although the cost of the water is more than that paid by householders who are connected to the city's water supply network, it is still far less than the exorbitant rates that had previously been charged by private water supply firms. The fact that the supply is piped into each home also saves time for the household member who previously had to wait in line at public taps, and eliminates the physical effort of carrying the water back to the house." (Espinosa and Rivera 1994, p19)

Again note, especially in the latter, the dependence on the institutional context.

For a note on communal sanitation, see Box 5.2.

Note also a caution, periodically expressed in the references, that high density may rule out on-site alternatives despite that conventional alternatives are unaffordable to low income communities (if they have to pay full costs). Briscoe made the point that much research in recent decades has focused on the on-site disposal of excreta. Pour-flush latrines and ventilated improved pit (VIP) latrines are often the technologies of choice, because they provide good service, including privacy and few odours, at a reasonable cost, and because their installation and functioning do not depend on the municipality or another sanitation agency. There are, of course, yet simpler improvements at even lower costs, such as the latrine slab programme ("Sanplat") that proved so successful in Mozambique. However, for a variety of reasons, "....including high housing densities, impermeable soils, and the need to

dispose of considerable quantities of domestic wastewater, on-site solutions do not function well in many urban areas. Sewage and wastewater collect in the street and low-lying areas, creating major aesthetic and health problems. And, in many settings, people aspire to "the real thing", waterborne sewerage." (Briscoe, 1993, p28).

"It is clear that exclusive reliance on conventional sewerage cannot solve the current predicament of increasing needs and dwindling resources. Recognizing the magnitude of the problem, sector institutions have begun investigating the use of alternative technologies. Much of this work has been directed at on-site systems..... However, in many situations - for example, high housing density, impermeable soil, or high water consumption - on-site systems are not appropriate. Under those circumstances, sewered alternatives to conventional sewers are needed." (Bakalian, Wright et al 1994, p1).

"Current sanitation choices can be described as a Roll Royce (conventional sewerage), a motorcycle (an improved latrine), and a bicycle (an unimproved latrine). What is missing is the Volkswagen - something that provides the same service as the Rolls Royce but which many more people can afford. Several types of "sanitation Volkswagen" are being developed:

- Effluent sewerage is a hybrid between a septic tank and a conventional sewerage system. Its distinctive feature is a tank, which retains the solids, located between the house sewer and the street. Because only liquid wastes flow into the street sewer, smaller sewers may be laid at flatter gradients and with fewer manholes. The homeowner must periodically pay to have the solids removed from the tank. Such systems have been widely used in small towns in the United States and Australia and in Argentina, Brazil, Colombia, India, Mozambique, and Zambia. The limited cost data suggest that solids-free sewerage costs about 20 percent less than conventional sewerage.

- Simplified sewerage, developed in Sao Paulo, is based on a different theory of solids flow in sewers, which allows smaller, shallower, flatter sewers with fewer manholes to be used. This simplified design works as well as conventional sewerage but costs about 30 percent less. It is now routinely used in Brazil.

- The Orangi Project in Karachi, Pakistan [Box 5.3] adapted the principles of effluent sewerage and simplified sewerage to the realities of a hilly squatter settlement. The result ... was drastic reductions in the cost of sewers ..... [90 percent on a per household basis,] excluding the cost of the trunk sewers.

- The requirement for large capital investments to exploit new and expensive water-supply sources can be deferred until some future date, thereby delaying the need to increase water tariffs.

- On-site wastewater-disposal systems become feasible in a large number of middle-income and upper-income communities, thus obviating the need for expensive conventional sewerage systems.

The conservation of existing drinking water supplies is, thus, not only relevant to the needs of low-income settlements, whose water supplies can thereby be improved, but also relevant to the needs of middle-income and upper-income communities, since they will not have to pay for unnecessary capital works to expand the water supply system and might also be able to avoid expensive sewerage charges." (UNCHS 1989, p4)

Chapters I through III of this UNCHS reference rigorously list and comment on a set of "structural" and "operational" methods of reduction in water wastage. These are listed under the headings -

- flow control devices
- metering
- recycling systems
- impact on sewerage and sewage treatment
- unaccounted-for water
- leakage detection and repair
- reduced line pressures.

The case study of the Mexico City Efficient Water Use Programme is of interest (Box 5.6) (Also Box 5.7, which also lists financial and socio-political measures.)

5.4 Complementary services assumptions, on which technological alternatives are dependent.

As noted above, these assumptions are broadly -

- if a water service is provided, will sanitation also be provided, and vice versa; or at least a means of dealing with sullage; and what about a solid waste service?
- will there be education in correct usage of the water and sanitation facility, and in general hygiene?

The necessity or otherwise for linking sanitation with water is the subject of ongoing debate. It would seem that assessment of the specific circumstances of each project is favoured by the international agencies. (Jagannathan, World Bank, personal communication, 1994)

Often, the decision to provide sanitation together with water reflects engineers' perceptions of negative externalities associated with unhygienic sanitation practices, rather than actual demand in communities.

A study of ten years of Brazilian experience suggests that if a large scale extension of water supply is successfully carried out, demand for sanitation facilities automatically goes up as well. Under these circumstances a separate sanitation investment programme can be sustained.

However, if there is no demand from the potential beneficiaries, a sanitation programme is almost certain to be unsustainable. This is borne out that in other water projects, especially those in rural areas or for urban people who had recently immigrated from rural areas, potential beneficiaries were by and large indifferent to sanitation infrastructure because (i) their immediate priority was securing access to water supply, and (ii) in rural areas the extent of negative externalities was also relatively less.

Some recent World Bank projects, such as in Paraguay, Sri Lanka and Indonesia, have attempted to "stimulate" local private (informal) sector participation in on-site technologies (such as, septic tanks, water sealed toilets, VIP latrines etc.) by the use of revolving funds and provision of free hardware (such as toilet bowls). There is still no indication on how successful these efforts are going to be, and one has to await project implementation experiences as and when they become available to provide insights on when a stimulation strategy succeeds and when it does not. (Jagannathan, World Bank, personal communication, 1994)

In one major Brazilian project, spread across several cities (see also Box 3.2), communities (most of which already have access to water supply) are advised of the range of feasible technological options by engineers of the State Water Company, and with the cost implications of each option being explained. Communities are then asked to choose an appropriate option:

- If there was preference for sewers based on conventional standards, operation and maintenance would remain the responsibility of State agencies, but sewer charges would be highest.

- The condominial system [Box 5.4] has been developed and applied in northeast Brazil and is now being used in low-income urban areas throughout the country. It comprises shallow, small-diameter backyard sewers laid at flat gradients, and costs about 70 percent less than a conventional system." (Briscoe 1993, pp 28 & 29)

But these innovations invariably assume a high standard operation and maintenance regime, neglecting which would be a considerable risk, as there is seldom much "tolerance" in these innovations.

For example: "In an effort to reduce the cost of sewer systems, a critical review of the basis of the conventional design standards has been carried out in Brazil. The result has been the development of a modified approach for sewer design based on hydraulic theory, satisfactory experiences elsewhere and redefinition of acceptable risk. Systems designed according to these new criteria are known as simplified sewers. These sewers operate as conventional sewers, but a number of modifications are introduced: the minimum diameter and minimum cover are reduced; the slope is determined by using the tractive force concept in lieu of the minimum velocity concept; installation of sewers is below sidewalks where possible; and many costly manholes are eliminated or replaced with less expensive cleanouts. Experience with these systems has shown that cost savings of 20 to 50 percent have been achieved. (Bakalian, Wright et al, 1994.)

Finally, Gakenheimer suggested that options such as water delivered by tank trucks not be dismissed out of hand, as there are many advantages to such "impermanent" solutions, especially in rapidly growing urban areas. (Gakenheimer 1993, pp 7 & 8)

5.3 Construction, operation and maintenance assumptions, on which technological alternatives are dependent

As noted above, these assumptions are broadly -

- how the facility will be constructed (i.e. workmanship)
- how the facility will be operated and maintained -
  - by the individual users
  - by those responsible for the "public" part of the facility.

The importance of workmanship being to specification needs no explanation.

It is more necessary to illustrate how important it is that the pre-investment assumptions of operation and maintenance are fulfilled. Space limitations dictate that only a couple of examples be drawn from

an extensive literature.

"In most developing countries, the performance of the water and sanitation organisations is poor, and maintenance is a chronic problem. Many systems are plagued by high levels of unaccounted-for water due to the failure to repair leaks or replace old pipes, the presence of illegal connections, and the lack of meters. In industrial countries unaccounted-for water is about 10 to 15 percent of net production. A recent study by the Bank's Latin American and the Caribbean Technical Department found unaccounted-for water in most Latin American countries ranging from 20 to 50 percent of net production. The revenue lost as a result of these high water losses are staggering. In Bogotá the revenue losses have been estimated to be equivalent to 25 percent of the total billings. "If captured, these financial resources would have been more than adequate to meet all debt service obligations ($195 million) during this period ... [In Mexico City the authorities have no] credible plan to meter consumption, maintain meters, and reduce the number of illegal connections. The magnitude of this neglect, coupled with low rates, requires a federal subsidy in excess of $1 billion a year (0.6 percent of gross domestic product), an equivalent to the annual sector investment needed to supply the total population of Mexico with adequate water and sanitation services by the end of this century." (World Bank 1993b, pp109 and 110)

It stands to reason that an essential technological component of any water and sanitation programme must be the adoption of technology to enable more efficient use of the resources. Programmes for more efficient use of the available supplies "... might, at first, appear to be of little relevance to communities with inadequate or scarcely adequate water supplies. They are, however, very relevant, since conserved water can be used to improve the overall water supply situation. This can be done, for example, by:

- Reducing the amount of water lost through leakage in the distribution system, which may often be as high as 50 per cent of the water put into it;

- Reducing the often excessively high level of water consumption in middle-income and upper-income communities, which can be readily achieved without sacrificing the high levels of user convenience favoured by these communities.

The achievement of these reductions has several benefits to the national economy, viz:

- Existing water supplies can be used to serve more people than before, especially those in low-income settlements, or to provide additional hours of service each day.

- If communities preferred to spend less, standards were adapted suitably. For example, condominial sewers and shallow sewers lowered sewer charges between 40 and 60 per cent, but operations and maintenance within the feeder networks (i.e. residential areas) became the responsibility of the community.

- In some cities, communities preferred investing resources on improving private toilets and on-site disposal instead. (Jagannathan, World Bank, personal communication, 1994)

The "non-construction" or "software" components of the projects (the term software being used to draw a distinction from the hardware or engineering investments) could cover some or all of hygiene education, training, technical assistance, support for women's activities, NGO support funding, setting up monitoring and evaluation systems, etc.

Experience from completed projects in China and the Philippines suggest some interesting contrasts:

- The Chinese project spent only $4 per capita on software, and the water supply infrastructure is reported to be working satisfactorily after project completion.
- The Philippines project spent $14 per capita on software, and the infrastructure is not working satisfactorily.

The Chinese project focused on hygiene education, and there was no expenditure on sanitation hardware. Philippines underspent on key components, such as training outlays at the community level, and overspent on other, non-essential components (such as overseas training for utilities engineers). (Jagannathan, World Bank, personal communication, 1994)

5.5 Resistance to "inferior technology"

Espinosa and Rivera said it all:

"... many low-income households are reluctant to invest in dry latrines when they know of the flush toilets used by middle and upper-income groups - even if each uses more water in a flush than their entire daily water consumption. When installing drainage pipes, there was a resistance to using the cheaper small-bore pipes because these differed from those used in wealthier areas and there was a concern that they would not work. "Alternative" technologies are often viewed by low-income groups as "second-class" and it has proved a challenge to the technical teams to overcome such attitudes. However, as other infrastructure improvements are made and education in sanitary conditions is provided, available low-cost solutions for sanitation are likely to be more widely accepted." (Espinosa

and Rivera 1994, p21)

Bartone advised that this resistance is best met by finding out what the communities' expectations are, without raising hopes that the higher levels of these can be met. Then "take the time for the people to adjust", by means that include -

- getting influential community members to be guinea pigs in pioneering appropriate technology
- showing to local entrepreneurs the potential benefits for themselves in, for example, being the suppliers of low-technology toilet systems. (Bartone, World Bank, personal communication, 1994).

5.6 Chapter 5 conclusions

The conclusions are, briefly, that -

- technology choice is wittingly or (often) unwittingly made in the context of a set of assumptions, and the validity of these assumptions will largely determine the success or failure of the technology;
- these assumptions relate to technological conditions that may be found at the project site, but also (principally - the list is not exhaustive) to: workmanship in construction; housing conditions; system usage; operation and maintenance; institutional factors (including enforcement (or not) of regulations); and the effectiveness of complementary services;
- in order for services to be sustainable, hard choices will often have to be made, trading off between levels of services, cost, and convenience (to name only a few factors);
- some of the innovative technological options save costs compared to conventional sewerage, but are very dependent on a high standard of operation and maintenance; a drop in this standard would be a considerable risk, as there is seldom much "tolerance" in the innovative options;
- programmes to enable more efficient use of water and sanitation resources (e.g. by reducing water wastage) are of great importance.

5.7 Notes on additional references

- Rotner pointed out that the task of providing water and sanitation is in many cities immensely complicated by the lack of control over land use. Especially this is so when landowners subdivide their land without permission, providing no services, but allowing people to stay on the land while paying rent. (In India, 30 - 40 % of the national housing stock is on such land.)

Often, the land is environmentally unsuitable for housing development, being (for example) too steep, or having too erodible soils. Apart from the environmental damage caused before services are provided (often many years later), a housing development is officially sanctioned on land that should have been reserved for some other, less environmentally detrimental, use. (Rotner, World Bank, personal communication, 1994)

- McGowan, Hodgkin and Kaplan stressed the need to decide beforehand whether the purpose is only to create a temporary relief system or to address emergency relief needs while also laying the groundwork for more permanent installations. Sometimes the immediate needs of communities force a less than optimal approach to technology design. Each option carries implications for the design of the short-term system.

  The same writers urged consideration, in areas of low levels of service, of providing short-term water storage capacity to households and small groups, and also ensuring that household water comes from these storage facilities. Back-up systems for supplying water in emergency situations should be included wherever feasible. This they regarded as a "cheap and efficient" way of increasing assurance of water supply. (McGowan, Hodgkin and Kaplan, 1992)

Box 5.1 A project below expectations : water and sanitation in Dhaka

The results of a water and sanitation project in Dhaka (Bangladesh) fell below expectations for a variety of interrelated reasons.

- The residents were not provided with appropriate knowledge of the water and sanitation systems.
- The residents themselves were allowed no role in determining priorities and in deciding on how these priorities would be met.
- The sanitation system chosen was not technologically suited to the settlement - plots were too small to accommodate a two-chamber latrine.
- Communal dustbins provided by the public authorities were so irregularly emptied as to discourage their use. Public authorities also failed to ensure the latrines were emptied regularly.

This is one of many examples of low-income settlements being provided with less convenient and accessible water, sanitation and garbage collection facilities than middle or upper-income groups are, and where public authorities failed to provide the support services (in this instance regular emptying of communal garbage bins and desludging of latrines).

(Hoque et al 1994, pp 72 - 85).

Box 5.2 Public or private latrines?

"Some sanitation programs for low-income urban areas have been based on the provision of public or communal latrines. Several arguments have been put forward in their favor. The installation of public latrines can be relatively simple to administer, with construction carried out on public land by contractors; and it avoids the need for negotiation with individual householders or landlords, or for the mobilization of voluntary labor. It can be less costly overall because of economies of scale. Public facilities can also be provided in areas where the population density is so high that there is not sufficient space to build a separate cubicle for each household. They may also help to make unsatisfactory household systems such as bucket latrines and chamber pots less unhygienic; many of those who visit a public latrine come carrying a container of night soil to empty into it. Special provision should be made for this kind of use.

In the long run, however, public latrines could easily prove more expensive than facilities for individual families. They have a heavy maintenance requirement, and a full-time attendant is needed. To pay for this, a charge usually has to be levied for their use. Even with a conscientious attendant, a public latrine is likely to suffer misuse and occasional vandalism, necessitating frequent cleaning and ongoing repairs.

More fundamentally, the user charges and the distance of a public latrine from the home, together with the need in most cases to lock up the facility at night, will inevitably deter some potential users. Special arrangements can be made for children to use them free of charge -- as in many public latrines of Kumasi, Ghana -- but this does not cater for the special difficulties of the elderly, the ill, and women fearful of walking to and from them after dark.

Although numerous descriptions of public latrine programs have been published, it is noteworthy that none documents an evaluation of them from the user's point of view. It is likely that any such evaluation would rapidly bring these and other problems to light. For example, monitoring of usage rates of public latrines in the Philippines has shown that some are used only by a minority of the population in their service area, and that nearly half the regular users visit them less than twice a day. Public latrines, even well-maintained ones, can never meet all the needs of a community for sanitation facilities. In practice, the experience of most cities is that public facilities are not well maintained in the long term. The best that can be said for them is that they are better than nothing at all.

Where space limitations make it impossible to provide an individual family latrine for each house, an alternative is to provide a communal block in which each family has its own cubicle and its own key to the door. The family is then responsible for cleaning and maintaining its part of the facility. Where individual family cubicles are not a feasible option, a second-best alternative is for each compartment to be shared by two or three families; in that case, it is important for each family to choose those with whom it will share to minimize the probability of disagreements about the sharing of duties between them. However, a careful survey of user preferences is necessary for any such sharing scheme, and the results can be surprising. In Indonesia, for example, it was found that many households preferred an (unsubsidized) private latrine to a (subsidized) shared one, even when the cost got them into debt beyond their means. As this example illustrates, the best decision for the program management will usually be to offer households or communities a choice, and let them decide which is most appropriate to their needs."

(Cairncross, 1992, pp 27 & 28.)

Box 5.3 The Orangi Pilot Project, Karachi

When in the early 1980s Akhter Hameed Khan began working in the slums of Karachi, he found that people in this area had a relatively satisfactory supply of water but that the streets were "filled with excreta and waste water, making movement difficult and creating enormous health hazards". What did the people who lived there want, and how did they intend to get it, Dr. Khan asked. What they wanted was clear: "people aspired to a traditional sewerage system .... it would be difficult to get them to finance anything else". And how they would get it, too, was clear - they would have Dr. Khan persuade the Karachi Development Authority (KDA) to provide it for free, as it did (or so they perceived) for the richer areas of the city.

Dr. Khan spent months going with representatives from the community to petition the KDA to provide the service. Once it was apparent that this would never happen, Dr. Khan was ready to work with the community in finding alternatives. He would later describe this first step as the most important thing he did in Orangi - "liberating", as he put it, the people from the" immobilising myths of government promises."

With a small amount of core external funding, the Orangi Pilot Project (OPP) was started. It was clear which services people wanted; the task was to reduce the costs so the services would be affordable and to develop organisations that could provide and operate the systems. On the technical side the achievements of the OPP architects and engineers were remarkable and innovative. In part thanks to the elimination of corruption and the provision of labour by community members, the costs (in-house sanitary latrine and house sewer on the plot, and underground sewers in the lanes and streets) were less than $100 per household in the late 1980s.

The local organisational achievements are equally impressive. OPP staff members have played a catalytic role: they explain the benefits of sanitation and the technical possibilities to residents, conduct research, and provide technical assistance. Staff members do not handle the community's money. Even in the project's early years the total costs of OPP's operations amounted to less than 15 percent of the amount invested by the community.

Households' responsibilities include financing their share of the costs, participating in construction, and electing a "lane manager" who typically represents about fifteen households. The lane committees, in turn, elect members of neighbourhood committees (usually representing around 600 houses) who manage the secondary sewers. The early successes achieved by the project created a "snowball" effect, in part because of increases in the value of property where lanes had installed a sewerage system. As the power of the OPP-related organisations increased, they were able to bring pressure on the municipality to provide funds for the construction of secondary and primary sewers.

The Orangi Pilot project has, since its inception, directly and indirectly assisted about one million people to improved sanitation. At least one progressive municipal development authority in Pakistan is seeking to follow the OPP method and, in the words of Arif Hasan of the Orangi Pilot Project, "to have government behave like [a nongovernmental organisation]." Even in Karachi the mayor has now formally accepted the principle of "internal" development by the residents and "external" development (including the trunk sewers and treatment) by the municipality.

continued

The experience of Orangi demonstrates graphically how people's demands move naturally from the provision of water to removal of waste from their houses, then from their blocks, and, finally, from their neighbourhood and town.

The OPP has evolved into the OPP Research and Training Institute which has developed model programmes for low-cost housing, for basic health and family planning for job- and entrepreneur-training for women, for supervised credit for microenterprises, and for upgrading privately-run schools.

(Khan 1992; World Bank 1993a; **Environment and Urbanization** 1995, pp 227 - 236.)

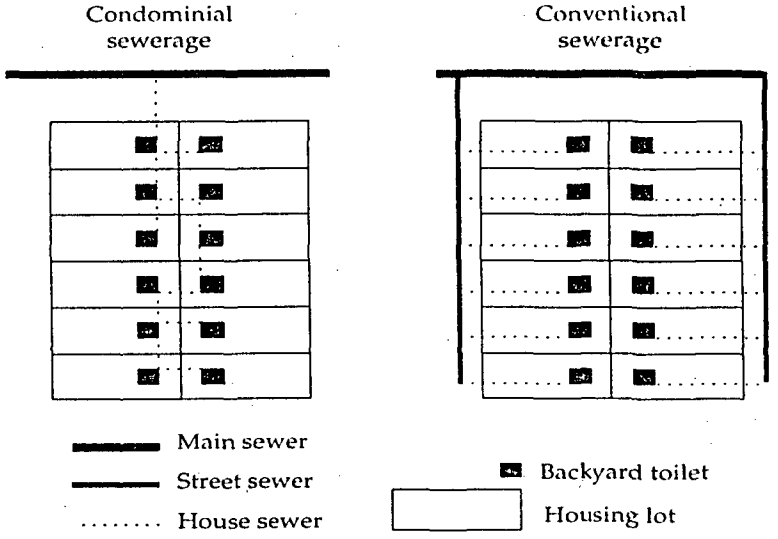
Box 5.4 The condominial sewerage system in Northeastern Brazil

In the cities of Northeastern Brazil, communities have been managing condominial sewerage systems that connect inexpensively to a block of houses. Success depends on residents jointly allowing the systems to be built on their land - thus the term condomonial.

The system is the brainchild of José Carlos de Melo, a socially committed engineer from Recife. The name "condominial" is applicable for two reasons: (a) the system treats a block of houses like a horizontal apartment building - "condominial" in Portuguese; and (b) "Condominial" was a popular Brazilian soap opera, associated with the best in urban life. As is evident in the figure, the result is a layout radically different from the conventional system. It has a shorter grid of smaller, shallower, "feeder" sewers running through the neighbourhood backyards. The effects of shallower connections to the mains ripple through the system. These innovations cut construction costs to between 20 and 30 percent those of a conventional system.

The more fundamental and radical innovation, however, is the active involvement of the population in choosing the level of service and in operating and maintaining the feeder infrastructure. The key elements are that families can choose: (a) to continue with their current (non-waterborne), sanitation system, (b) to connect to a conventional waterborne system, or (c) to connect to a condominial system. If a family chooses to connect to a condominial system, it has to pay a connection charge (financed by the water company) of, say, X cruzados and a monthly tariff of Y cruzados. If it wants a conventional connection, it has to pay an initial cost of about 3X and a monthly tariff of 3Y (reflecting the different capital and operating costs). Families are free to continue with their current system, which usually means a holding tank discharging into an open street drain. In most cases, however, those families that initially choose not to connect eventually end up connecting. Either they succumb to heavy pressure from their neighbours or they find the buildup of wastewater in and around their houses intolerable once the (connected) neighbours fill in their stretches of the open drain.

Schematic layouts of condominial and conventional sewerage systems



continued

Individual households are responsible for maintaining the feeder sewers, and the formal agency tends to the trunk mains only. This increases the communities' sense of responsibility for the system. Also, the misuse of any portion of the feeder system (by, say, putting solid waste down the toilet) soon shows up as a blockage in the neighbour's portion of the sewer. This leads to rapid, direct, and informed feedback to the misuser. The result is virtual elimination of the need to educate users in the do's and don'ts of the system and fewer blockages than in conventional systems. Finally, because of the utility's greatly reduced responsibility, its operating costs are sharply reduced.

The condominial system is now providing service to hundreds of thousands of urban people in Northeastern Brazil and is being replicated on a large scale throughout the country.

Note however that, if similar schemes are contemplated for other areas, there is danger in regarding the "clever engineering" as the essence of the system. Where the community and organisational aspects have been missing, the technology has worked poorly (as in Joinville, Santa Catarina) or not at all (as in the Baixada Fluminense in Rio de Janeiro).

(Bakalian and Jagannathan, 1991; Mejia et al 1993; World Bank 1993a; Briscoe, World Bank, personal communication, 1994; Nance, World Bank, personal communication, 1994; Watson 1995.)

Box 5.5 "Primacy of the short term" : Burkina Faso

Jaglin described what she referred to as "the primacy of the short term", that is so inhibitive of ongoing maintenance effort.

"Citizen mobilization does not just tend to give priority to investment, it is also inclined, in the short term, to select projects where a degree of consensus can easily be obtained. [Thus, for example] although the hazards of inadequate drainage were often mentioned [by the citizens in a case study in Burkina Faso], the inadequate initiatives to deal with this bear witness to this hesitation with becoming involved in ... activities that imply taking a long term view ...

Conversely, success in providing facilities can be explained by the nature of the effort required : the construction or renovation of buildings to house local public services, simple to organise and implement, with a limited time scale and clearly tailored to individual requirements, was a way of maximising the efficiency of mobilisation without new and original solutions.

Schools, for example, ... Whatever the final use for the building, the straightforwardness and speed of implementation of the work (which took four to five months on average) attracted citizens who were keen to see a quick return on their efforts.

However, after inauguration, operating problems often emerged ... Even in the schools ... maintenance of the premises, repair or replacement of desks and benches, the purchase of teaching materials, and cleaning and emptying the latrines were not carried out properly. In principle, the budgets of the schools ... were specifically intended to cover this expenditure but, inadequately endowed, poorly managed and sometimes misappropriated for the initial investment, they did not provide a satisfactory solution to the daily management of these establishments. Yet, the revolutionary committees did not come up with any answers: although effective in funding the investments, they neglected the issue of maintenance ...

While playing a decisive role in the short term in getting buildings and infrastructure in place, the revolutionary committees' lack of interest in daily maintenance was a major cause of failure in the campaign for public latrines ... [Despite involvement of local] people (who supplied workers for digging and finishing off), use of the latrines was short-lived and barely influenced previous practice. Poor management ... is the primary reason for this lack of success: the revolutionary committees made little effort to arouse interest in the job of an attendant, a job that was essential to maintain the facilities and collect the fees. Many of these jobs were only filled episodically despite competition to take charge of managing water points or supervizing other public facilities. Dirty, smelly and suspected of causing disease, the conveniences were not used and then abandoned. The revolutionary committees preferred to replace the campaign for public latrines with the slogan "one plot of land, one latrine", thus off-loading responsibility for the problem onto families.

"Attempts to collect household wastes were scarcely more successful."

(Jaglin 1994, pp121-123)

Box 5.6 Mexico City Efficient Water Use Programme

"Mexico City has a population of over 10 million people, and the average water consumption is 320lcd. Water is expensive to supply to this rapidly growing metropolitan area (average growth rate: 3.2 per cent during 1975 - 1985), and currently the newest supply to the city involves pumping water up from the Valle de Mexico which lies some 1 000m below Mexico City. Further augmentations to the city's water supply will be very expensive, and it is against this background of water scarcity and escalating costs that the city introduced in 1985 its Efficient Water Use Programme (Programa del Uso Eficiente del Agua).

The fundamental objective of this programme is to ensure that consumers can satisfy all their water-use needs with small quantities of water. The programme has five specific objectives:

(a) Obtain maximum use of existing supplies;
(b) Improve the administration of water-supply and sewerage services;
(c) Regulate the supply of water and sewerage systems;
(d) Encourage efficient water use by consumers;
(e) Reduce the quantity of water used by toilets, showers and other plumbing fixtures.

Additionally, the programme includes such activities as leak detection and repair (the city has over 12 000km of primary and secondary distribution mains); updating of plumbing codes; improved consumption control by metering; installation of some 500 000 water-saving devices per year; and elimination of in-house water losses.

Since 40 per cent of all water used in Mexico City is for domestic purposes (flush toilets, showers, sinks), emphasis has been given to the adoption of water-saving fittings and fixtures, and to the training of plumbers in their installation. The medium-term plan is that low-water-use fittings and fixtures should be used by all consumers. Three strategic actions are in force:

(a) Mandatory installation of water-saving fittings in all new houses;
(b) Their installation in existing unsewered houses prior to their connection to a public sewer;
(c) Promotion of their use in existing houses which have both water-supply and sewerage (some 75 per cent of the total), and a revised tariff structure designed to encourage their installation.

Specially designed 4-litre flush toilets and low-flow shower-heads and taps are all in local manufacture. A vigorous public education programme is also in operation - slide shows, video-films, brochures, personal letters to consumers and car stickers have been produced to increase public awareness of the magnitude of the water crisis. Governmental and other public buildings all use only water-saving plumbing fixtures, and a pilot-scale study on domestic water use has shown that consumption can be decreased by as much as 35 per cent, principally owing to the replacement of existing cistern-flush toilets (which use around 20 litres per flush) by 4-litre flush toilets. The programme has been very successful and will continue at least for the immediate future."

(UNCHS 1989, pp 40&41)

Box 5.7 Demand management programmes for municipal water supply

"In their efforts to limit the need for increased water supplies, many municipalities have employed demand management programs.

- The city of Bogor, Indonesia, was faced with high investment costs of developing additional water supplies. The municipal authorities decided to substantially cut the water consumption levels of domestic and commercial consumers. Water fees were increased initially by approximately 30 percent, resulting in an average decrease in consumption of 29 percent. This action was followed by a campaign to reduce water use further, particularly among consumers with monthly consumption of more than 100 cubic meters. Consumers were given advice, as well as the necessary devices, to reduce consumption. Three months after the campaign started, average monthly water use had decreased another 29 percent.

- In its efforts to cut water use per capita by one-sixth, Mexico City has replaced 350 000 toilets with smaller six-liter models. This has saved enough water to meet the household needs of 250 000 residents [of the more than 10 million in Mexico City].

- A new pricing system in Beijing links charges to the amount of water used. New administrative regulations set quotas on consumption and authorize fines for excessive use.

- The use of water-saving devices, leak detection and repair, and more efficient irrigation in its parks helped Jerusalem reduce its use of water per capita by 14 percent from 1989 to 1991.

- A water conservation program in Waterloo, Canada, included higher prices, education, and the distribution of water-saving devices. Volunteers distributed water conservation kits to nearly 50 000 homes. Water use per capita declined nearly 10 percent."

(World Bank 1993b, p53)

6. EXPERIENCE IN INSTITUTIONAL, LEGISLATIVE AND FINANCIAL ISSUES

6.1 The need for appropriate frameworks to be structured and resourced : infrastructure in general

6.1.1 General

An appropriate institutional, legislative and financial framework is essential for the success of water and sanitation programmes. This is the evidence of the international experience.

Characteristics that should be examined are the structure of institutions, the division of tasks between them and their relationship with each other (including private organisations and other roleplayers), their legislated capacity, and their financial resources (and the sources thereof). In doing so, it should be acknowledged that these characteristics themselves are only one set of factors that determine the success or failure of institutions. Other influential factors include the people who run the institutions and the environment within which each operates.

Section 6.1 describes the reported international experience on infrastructure in general, whereas Section 6.2 is more specific on water and sanitation provision.

6.1.2 Public and private sector formal institutions

Davey set out "six criteria" for evaluating the effectiveness of urban institutions tasked with infrastructure provision, viz:

"1. Technical competence in the choice, design and execution of investment in infrastructure and in its operation and maintenance.

2. Efficiency in the use of resources - financial, human, and physical - through good budgeting, project appraisal, personnel management, and program execution.

3. Financial viability based on vigorous exploitation of the local revenue base and on sound financial management.

4. Responsiveness to the needs arising from urban growth, with the ability to plan the development of the city and its services ahead of, or at least in pace with, demand.

5. Sensitivity to the needs of the urban poor and a weighting of public interventions to promote their access to shelter, basic services, and employment.

6. Concern for environmental protection through public service provision and the regulation of the private sector." (Davey 1993, p viii.)

The shortage of urban services in many developing countries is in large part due to shortfalls in financial capacity, which are in turn largely due to -

- reducing assistance (relative to increasing need) from the source of much of the traditional funding, viz, national government
- insufficient access of local governments to credit
- inadequate policies for the pricing of services, and
- that low-income communities are often unable to afford the services.

The evidence of the international experience is that, to achieve improvement, this traditional reliance in developing countries on funding from national government will have to be replaced by an expansion of local sources of revenue (particularly increased reliance on user charges) and revised formulae for national-to-local grants.

Another aspect of institutional resourcing is the capacity of the institutions concerned. "Columbia, for example, is committed to decentralising responsibility for water supply, sanitation, urban transport, and primary education to local governments by 1992, yet rapid fiscal decentralisation at the end of the 1980s has not been accompanied by strengthening technical capacity at the local level." (World Bank 1991, p61)

The World Bank also noted that: "In most countries many essential services in cities are managed by local governments. Public-sector management is commonly a concern at all levels of government but the financial and technical weakness of municipal institutions can place severe constraints on important urban-based economic activities as well as on public health.... Central control of financial resources has limited local financial autonomy and efforts to mobilise resources. In many countries, central governments assign narrow-based or politically controversial tax bases to local authorities and then further constrain local resource mobilisation by controlling the rates of local taxation. Intergovernmental transfers, which account for more than half of the local recurrent revenue, give perverse incentives: recurrent transfers frequently reward [those] local governments [that have] the largest deficits. .....

It is clear that municipalities require access to sufficient buoyant sources of revenue to provide local services. Most local governments have local revenue sources, commonly the property tax and some local business taxation, but local sources typically account for less than half of total revenue. Improvement in tax assessment and collection can increase revenues over the longer term." (World Bank 1991, pp40 and 41)

Few city or municipal authorities or national agencies concerned with service provision have a large enough technical and financial base to allow them to ignore the resources that other groups, such as community organisations, NGOs, private foundations and international funding agencies, can bring to service provision. One notable aspect of many of the case studies is how joint actions by public agencies working with low-income households, NGOs and international agencies, managed to improve service provision to low-income households and communities at a relatively low unit cost (compared to the cost of using conventional means) and with substantial or total cost recovery.

The World Bank concluded that: "Because of their limited financial and administrative resources, governments need to be selective in the responsibilities they assume for water resources. The principle is that nothing should be done at a higher level of government that can be done satisfactorily at a lower level. Thus, where local or private capabilities exist and where an appropriate regulatory system can be established, the Bank will support central government efforts to decentralise responsibilities to local governments and to transfer service delivery functions to the private sector, to financially autonomous public corporations, and to community organisations such as water user associations. The privatisation of public water service agencies, or their transformation into financially autonomous entities, and the use of management contracts for service delivery will be encouraged. Arrangements for ensuring performance accountability and for putting in place an appropriate regulatory framework to set and enforce environmental protection standards and to prevent inefficient monopoly pricing will be incorporated into Bank-supported activities." (World Bank 1993b, pp15 and 16)

Thus, "... where local management capabilities make it feasible, increasing the reliance on decentralised mechanisms changes the nature of the government's job. Instead of distributing water, the central government should focus on establishing incentives to ensure that water is distributed in the desired quality and at the lowest possible price that reflects its value (taking into account the special needs of the poor)." (World Bank 1993b, p54)

Positive experiences in private solid waste collection and disposal in Brazil, management of urban water supply in Chile, and power generation in several countries suggests that private sector provision of infrastructure services can be positive if the regulatory framework is well defined and is enforced. (For example Box 6.1).

Private operation and maintenance (but not necessarily ownership) of services may be effective in cases in which consumers can be charged and the scale of the investment, the technology, and the maturity of the business sector permit competition. Where technology and the scale of investment are likely to deter competition and encourage monopoly supply, private provision may also be effective, but only if urban government has the capacity to protect the public from excessive charges and to ensure that services at the level of basic need are affordable to low-income consumers. Vital to

effective and efficient delivery are whether services are publicly or privately managed, and the specification and costing of performance standards, including maintenance and replacement cycles. (Briscoe, World Bank, personal communication, 1994)

Mabogunje pointed out that most of the literature on institutions refers to formal sector institutions and especially "to existing government departments". "Thus urban policies emphasize strengthening institutions that deliver services - employment, transportation, shelter, education, health and so on - rather than those that enable "commodity producers" to accumulate more capital and create wealth." (Mabogunje 1991, pp194 and 195)

Although many of the programmes and policies designed to address urban issues may be more than adequate in the short term - and, if they address urgent and immediate deprivation or hazardous situations, are very necessary, ".... their long-term success is vitiated by their failure to transform the traditional institutions that are relevant to the lives of most urban residents. Such institutions are usually identified in the literature as belonging to the "informal" sector. The failure to pay serious attention to these institutions is also marked by the preoccupation with urban poverty and the somewhat patronizing response that it elicits. As a result, the more challenging task of improving the productivity of urban economies tends to be neglected.

This calls for a new paradigm for urban policy in developing countries - a paradigm concerned with transforming indigenous institutions so they will be compatible with the demands of a free market economy. ... the population of cities [must be] made more productive and more entrepreneurial. It is thus of considerable importance ... to remove those critical constraints that have inhibited rapid economic development. Among the key constraints are infrastructural deficiencies, the regulatory framework governing urban markets for land and housing, weak municipal institutions, and inadequate financial services for urban development." (Mabogunje 1991, pp192 and 206)

6.1.3 Communities and individuals

Rabinovitch pointed to the advisability of greater involvement of community organisations and NGOs in developing "local solutions" on the basis of their local knowledge and experience, and on devolving responsibility to the lowest, most local institution or grouping that has the competence necessary, with the proviso that that institution or group is adequately resourced. (Rabinovitch and Leitmann 1993, p 49 & 50)

However, apart from the need to involve local communities in the development of **solutions**, what is often neglected is consultation as to their **priorities**.

Discussions among professionals working with governments and aid agencies on how to improve infrastructure and service provision in illegal or informal settlements generally centre on how to reach as many people as possible with limited resources. The inhabitants are rarely consulted as to their priorities. If they are, priorities that fall outside the remit or experience of the external agency are ignored. A perusal of self-critical international literature shows how common it is to find the inhabitants of low-income settlements receiving water projects when their priorities are improved public transport and better income-earning opportunities (of which some form of day care is often important, as it makes it easier for those responsible for child care - almost always women - to earn an income)

Even when a particular kind of intervention has been agreed upon, the inhabitants are rarely involved in choosing what interventions should be made, in determining how much should be spent and in developing the most appropriate ways of cost recovery. Low-income families are often prepared to pay more for water than is assumed by external specialists, because of the time and effort they save through securing a better quality water supply (for instance a supply piped into their homes, rather than a communal tap) (See Espinosa and Rivera in Section 5.2 above). They are often prepared to contribute their time and organisational capacity in helping to pave roads, dig ditches, provide volunteer support for health or day care centres, if their priorities are addressed and they retain a say in how this takes place.

There is often insufficient recognition of the crucial role that women play in water and sanitation at the household level. Hence the merits of women's participation. In many societies, women would not automatically become involved, and a determined effort is necessary to ensure their participation in decision-making. The projects emphasised community participation and included primary roles for women, but not to the exclusion of men. In many other cases, women spend 15 percent of their time fetching water. Given women's heavy work load, the time spent hauling water keeps them from other productive and household-caring activities and impairs their health and well-being. In urban areas, user participation that includes women is also promising for improving sanitation. This is essential, particularly in that (i) many households are headed by women, and (ii) it is the women who are usually primarily responsible for bringing up the children. (The role of women is described further in Section 8.6).

In order for communities to participate in the decision-making process of infrastructure provision, it may well, depending on their background, mean that they need capacity building. Which could be by general education, formal training in relevant skills, and/or by experience.

There is a call for a paradigm shift in public participation from the concept of people as consumers and beneficiaries (that is, the recipients or consumers of project inputs), to people as "resource managers". People will take responsibility and groups will come together to manage assets. However, they will not come together to manage liabilities, which is what results when "participation" is simply requiring

people who are regarded as consumers to pay for services or contribute labour to the construction of physical facilities. (Yacoob, Research Triangle Institute, personal communication, 1994)

Infrastructure programmes are most sustainable if they have inbuilt mechanisms that guide the behaviour of all, individuals through to major corporations, in ways that reinforce the programmes. Thus programmes and techniques must take account of the motivations of those managers, politicians, community leaders, workers, or whoever is likely to be involved in their implementation. The task therefore is to seize on particular times and methods of introducing programmes so that roleplayers find it to their benefit to act in ways consistent with these programmes. Again, the extent to which such issues are amenable to change will depend on the specific administrative traditions and economic conditions in each set of circumstances. (This point is returned to in Section 6.2.2. and Chapter 9, especially when addressing issues such as free ridership.)

Several case studies supported this, illustrating that there are limits to the degree to which and the occasions for which individuals can be mobilised on water and sanitation.

- Citizen mobilization, not difficult for ad hoc projects, can have effect if the project duration is short and progress is tangible and visible: such as spontaneous mutual aid to repair flood damage.

- There is no substitute for proper contingency planning to design and fund adequate protective measures. For example, drainage: ".... There is no point in having a partial network of drainage channels, so all residents must support their construction. Yet no ..... committee was able to impose such social co-operation on the inhabitants, most of whom were not directly affected by the problem and whose resistance was reinforced by the ineffectiveness of the few gutters that had been dug and then left unmaintained." (Jaglin 1994, p123)

Also, amenability to change will depend on cultural practices. Yacoob presented the case for assessing existing cultural practices in a community and then using them to encourage behaviour changes that, along with water and sanitation technology, will lead to improved health. (Yacoob 1994)

Legitimacy, transparency and capacity notwithstanding, personalities and the political will and the commitment of the public administration to "getting things done" (or the absence of these) can make or break even the most suitable institution, or can be the catalyst for successful management despite adverse circumstances. Rabinovitch pointed out how many of the Curitiba "innovations and accomplishments", and its overall success, may not be transferable because other cities may lack "... the political commitment, leadership, and continuity that Curitiba had enjoyed over the last twenty years. Much of this is attributable to one person - Mayor Lerner - who initiated and implemented many of these innovations during his three terms in office.... Trained as an architect and planner, Mayor

Lerner combined the skills of a professional with those of a charismatic politician to promote the environmental reforms and initiatives that are referred to in this report." (Rabinovitch and Leitmann 1993, pp9 and 50)

Development, whether at small or large scale, requires certain key participants within the community. If they are not there, suitable persons should be identified and trained, and then adequately supported by those with responsibility for the broader area -

- a "programme champion" who can recruit participants, motivate and inspire them, and co-ordinate their activities
- a "political steward" who knows the local political scene, and who can influence it
- a group of "core volunteers" who form the backbone of the community group. (Braddy et al 1992 pp180 - 181)

These individuals plan activities and implement them, and serve as the collective memory for the group.

Hasan and Khan pointed out that there are four types of barriers that can prevent communities uplifting themselves and taking responsibility for their own growth management and development. These are -

- psychological
- economic
- technical, and
- sociological barriers. (Hasan 1990; Khan 1992)

With capacity building, and given favourable circumstances, communities can be assisted to overcome each of these barriers.

As an example of a psychological barrier : The main mover and shaker for what became the Orangi Pilot Project initially spent months going with the representatives of the community to petition the Karachi Development Authority to provide, for free, the waterborne sanitation they wanted. "When it was clear that this would never happen, Dr Khan was ready to work with the community to find alternatives. (He would later describe this first step as the most important thing he did in Orangi - liberating, as he put it, the people from the immobilizing myths of government promises.)" (World Bank 1993a, p109; see also Box 5.3 above.)

Finally, outside agencies can offer technical and other forms of support, but should not, even inadvertently, compete with community groups for territory or influence. Betancourt stressed that the best way to start a project is often to approach a community through its existing organisations, even of these organisations are limited in scope and effectiveness. They should then be worked through and resourced and transformed. They should not be ignored or regarded as irrelevant. Even if some

of the organisations are criminal, they must be dealt with - in many South American projects the authorities have to recognise and negotiate with the gangs. This is not a comfortable situation, but it must be done otherwise these mafia block the project, maybe threatening or even killing the workers. (Betancourt, World Bank, personal communication, 1994)

6.1.4 Regulatory revisions

"In most cities in developing countries, large proportions of total population live in informal settlements where structural problems exist concerning the access of the poor to essential services. Rigid regulatory regimes and deficient infrastructure have historically had their worst impacts on the poor. Regulations often give the poor no alternative to informal settlements, and limit access to basic services." (World Bank 1991, p47)

Wegelin and Bergman described a set of "major interventions" that have considerable potential to alleviate the poverty in urban areas. Many of these are "enabling and facilitating in nature and do not require very significant investment." However, they must be co-ordinated - no intervention must be made in isolation. Where, of the this set, "municipalities are likely to primarily focus," because it may have the greatest cost-benefit for a relatively small investment, is "on reform in the regulatory area." (Wegelin and Bergman 1995, pp 150 and 151)

"A typical pattern is one of cumulative regulations imposed over time, each designed to respond to a specific problem. The net effect is to produce higher overall costs that outweigh the intended benefits of individual rules." (World Bank 1991, p 38)

Thus revisions to regulatory frameworks to make them more responsive to the requirements of the poor are often a necessary component of an infrastructure programme.

The close relationship between households' access to housing and access to water and sanitation is self-evident. In view of that, regulatory reform to facilitate housing will, by definition, facilitate access to water and sanitation. As follows: "Municipalities and central government agencies may modify the regulatory framework related to land supply and building and planning regulations. Such modifications should, for example, be geared towards simplifying procedures, towards greater flexibility in approved building standards and materials, and towards providing opportunities for income-generating activities by the acceptance of multiple uses of dwellings." (Wegelin and Borgman 1995, p139)

"High, unaffordable land use and building standards, often established by national ministries, also constrain local productivity and development. A study of housing markets in Malaysia showed that overly elaborate and time-consuming regulations increased housing costs by up to 50 percent. More than 50 permits are required to develop a housing area, a costly process that often takes four to seven

years. Most of the urban poor are thus shut out from access to land and adequate shelter." (World Bank 1991, pp38 and 39)

Hogrewe et al drew attention to the uncertain tenure status of many households. Where they live lacks official recognition as legal residential areas because the land they occupy usually has not been zoned for housing or is considered dangerous or environmentally protected. "Either the residents occupy the site without legal land tenure or they buy it from the landowner, who in turn has not legally urbanized the land (that is, legally registered the land or plots and installed or brought in municipal services such as electricity and water). In both cases, governments are reluctant to provide sanitation infrastructure to a settlement because that would imply that they recognize the settlement's legality. In many developing countries, government officials hold biases against squatter areas and providing assistance to them.

..... Because unstable land tenure means residents can eventually lose the land, they often are less willing make home improvements. Moreover, in these cases, lenders may decline to lend money for such improvements.....

Specific legal issues that may need to be assessed when designing a sanitation improvement project include land tenure, plot registration with municipal authorities, and the applicability and appropriateness of building codes, design and construction standards, and environmental regulations.... Indeed, sanitation improvement projects can help to accelerate the natural transformation of peri-urban areas into formally recognized communities. Conversely, when an area obtains legal land tenure, residents have more impetus to demand infrastructure." (Hogrewe, Joyce and Perez, 1993, p 36.)

6.1.5 Finance

"Maintenance and delivery of urban services are seriously constrained by the lack of financial resources of the governments at both local and national level. New areas of research should include (i) local governments' participation in financial markets, (ii) deregulation and private sector participation in the supply of infrastructure services, and (iii) the complementarity between public and private investments. "(World Bank 1991, pp 17 and 77)

As in respect of regulatory reform, any financial reform that improves access to housing will, by definition, improve access to water and sanitation. For example: "The quality of housing finance institutions could be enhanced by increasing the physical accessibility of these institutions and by offering the type of services (such as communally collaterized loans) which meet the demands of low-income groups. Municipalities could promote this, which will reduce the urban poor's dependence on expensive informal sector finance. In India, the Housing Development Finance Corporation has

recently broken new ground by lending, through NGOs, to slum residents to build or improve their houses at interest rates almost half of the informal market rate, using donor funds for the establishment of a risk guarantee fund." (Wegelin and Borgman 1995, p139) (See also Box 6.2)

"The lessons of experience suggest that an important principle in restructuring public service agencies is their conversion into financially autonomous entities, with effective authority to charge and collect fees and with freedom to manage without political interference. Such entities need to work under a hard budget constraint that enhances incentives for efficiency and revenue generation. Of greatest importance, the hard budget constraint unlocks incentives to collect fees and to provide services that consumers .... want." (World Bank 1993b, p55)

Finance, as it is bound up with cost, price and affordability, is discussed further in Chapter 9.

6.2 The need for appropriate frameworks: water and sanitation specifically

This Section 6.2 summarises international agency experience specifically on water and sanitation. All the experience reported in Section 6.1 is also applicable.

6.2.1 Processes and priorities

The 1980s were declared the "International Drinking Water Supply and Sanitation Decade". National initiatives reported some notable successes in this period. Particularly, several Brazilian cities successfully tested "intermediate" technology infrastructure and institutional options. Other successes were reported from Indonesia, Pakistan and Peru.

But there were failures also, for example in terms of technology being installed that was apparently "appropriate", but the institutions set up to operate and maintain the systems failed to do the job, and/or consumers who had promised financial contributions then reneged on these promises.

It became clear that few publicly-funded infrastructure utility agencies are suitable organisations for operating and maintaining facilities in low income communities if these facilities are not "conventional" (e.g. waterborne sewerage) and/or street patterns are not regular. Most of these agencies have neither the resources nor the manpower to operate and maintain networks within these settlements. Added to that, they are often totally pre-occupied with complex managerial and technical problems associated with bulk production, distribution and collection. Although some countries, like India and Pakistan, created separate Public Health Engineering Departments to handle the water and sanitation problems of these settlements, their track records appeared to be no better in terms of serving the poor. (One reason for this is that the operation and maintenance responsibilities in these organisations were usually regarded as "dead-end" positions.) (Jagannathan, World Bank, personal communication,

1994)

These agencies, it was therefore argued, could at best only provide technical assistance and supervision support for constructing the facilities. In contrast, the construction, operation and maintenance had to actively involve beneficiaries.

An essential ingredient of "success" is well designed participatory and interactive processes between the providers and the householders, the beneficiaries of the infrastructure. Subsequent Bank work revealed however that the substantive issues are somewhat more complex than just the participation of householders. Also needed are -

- confirmation on whether householders wanted the infrastructure at all, and
- convincing evidence that even if they wanted the infrastructure they would pay for system upkeep in the post-construction or operational phase (i.e. the risks of "free rider" problems had to be minimised).

The first of these, broadly, is whether the householders, even if they want the infrastructure, have yet higher priorities. For example, if employment opportunities, rather than water and sanitation infrastructure, are the number one priority, the focus of localized public investments should perhaps first be toward employment creation. Sectoral funds would be better served, in terms of maximisation of both welfare and efficiency, if they are channelled to other areas where demand for water and sanitation infrastructure is perceived as the highest priority. (See also Box 6.3)

The logical next step in placing the responsibility for prioritisation with the community is to offer a block grant - the people can then decide for themselves what services they want, within their given budget. This is presently being considered in a project in Uganda, but within engineering services only - i.e., the alternatives are only between combinations of road, water, sanitation, stormwater, etc. (Tschannerl, World Bank, personal communication, 1994)

The second issue is that communities often exhibit opportunistic behaviour after construction. The typical scenario is as follows : Before project implementation, householders express their willingness to contribute (cash or effort) to operation and maintenance. Once physical construction is completed, the same persons become reluctant to shoulder any operation and maintenance responsibilities, or even to pay subsidised tariffs.

This tendency toward free ridership is a natural human response, but is aggravated in many developing countries because householders are aware that there is neither the institutional capacity nor the political will to enforce their part of contractual obligations. The common justification is: "It doesn't belong to me, so why should I pay, especially if the service provider cannot force me to?"

The consequence will often be the abdication of the provider. For example, if householders in a low income community neglect to pay subsidised water bills, a utility agency may find it politically and institutionally more convenient to stop providing operation and maintenance support and to write off the infrastructure, rather than get involved in a time-intensive process of prosecuting every recalcitrant consumer.

To sum up, World Bank experience indicates that infrastructure projects targeted at low income communities need to focus on providing services -

- that people want and are willing to pay for and
- that incorporate sufficiently robust enforcement incentives to ensure that householders fulfil contractual commitments, thereby enabling sustainability.

While the case for infrastructure targeted at low income communities might be a persuasive one from the public welfare perspective, if operation and maintenance problems are recognized as the rule rather than as the exception, the substantive issue becomes one of designing enforcement incentives. Group guarantees are easily given before construction begins; the difficult part is realizing (i.e. enforcing) the guarantees once construction is completed. When a push comes to a shove, who will honour their agreement? What incentives (sanctions and rewards) are in place to ensure that they will?

World Bank opinion on prioritisation is steadily swinging from the equity approach (i.e. improve everyone's circumstances at the same time) to an approach that improves a select number at a time, doing the easiest ones first, or first doing those that can give greatest leverage. (See Box 7.2)

Finally, projects increasingly incorporate a linking of investments to incentives - i.e. some investments are made conditional on the beneficiaries fulfilling predetermined requirements. (Betancourt, World Bank, personal communication, 1994; Briscoe, World Bank, personal communication, 1994. Also Box 6.4.)

6.2.2 Case studies

The international agency case studies of water and sanitation illustrate the lessons to be learned from the unique combinations for each case of -

- technology
- consultation
- economic perspective
- selection criteria
- institutional arrangements
- together with the contextual factors, such as expectations, and history of cost recovery in nearby projects.

Jagannathan, in an in-house study of nine urban or rural water and sanitation projects funded by the World Bank, noted that the success or failure of a project takes place within an institutional structure, having administrative rules, procedures for channelling funds, procurement arrangements, reimbursement procedures etc. The extent to which projects are successfully built, and are sustainable through their designed life, depends on whether the above enable -

- decentralisation of decision-making, to give communities voice
- ensuring accountability of officials to beneficiaries
- simplifying disbursements and payments, and
- evaluation and feedback mechanisms.

Table 6.1 summarises the institutional innovations in terms of consumer voice and accountability that these nine projects have between them attempted to introduce.

Most of the above projects have recognized and built in a special role for community-based organizations (CBOs) during the project cycle. Some of the projects require CBOs to perform key planning functions, without which the scheme would not be approved. For example: deciding local service standards (Brazil), preparing Village Action Plans (Indonesia) and Project Proposals (Sri Lanka). In other projects, CBOs are required to take over operation and maintenance responsibilities of completed schemes.

The actual structure of these grass roots organisations differ from country to country, reflecting the political and cultural diversity.

Many of the projects have allocated large amounts to finance facilitation and training, by NGOs and private consulting firms, of project staff and community members. In the Brazil project, several forms of facilitation are being tried out, ranging from private consulting firms and public extension agencies to NGOs. In the Asian projects, facilitation is generally being undertaken with NGO assistance. Some expatriate technical assistance support is provided in Sri Lanka, Pakistan and Indonesia.

In Sri Lanka and Indonesia, suitably experienced NGOs are being awarded contracts to construct simple schemes. In the Brazil project, costs in some cities are being greatly reduced by awarding small contracts to local firms, rather than the prevailing practice of inviting only national-level firms to bid for Bank-funded water and sanitation projects. (Jagannathan, World Bank, personal communication, 1994)

The likelihood of cost recovery and the prevention of free ridership is very dependent on institutional capacity, but also on communities' perceptions of the ability of institutions to deliver services and to implement cost recovery.

As Jagannathan observed, the sustainability of the projects is largely dependent on cost recovery. The critical institutional constraint is thus one of designing a means to enforce guarantees given beforehand by the community.

Much depends on -

- institutional ability to bill for the service accurately and regularly
- local tradition of cost recovery, and particularly beneficiaries' perception of the likelihood of the penalising of defaulters
- the degree to which beneficiaries consider that they "own" the service
- engineering design.

In more detail:

What may be appropriate in one tradition of cost recovery, could be very inappropriate in a different tradition. To illustrate : China has an administrative framework in which little community choice is permitted and cost recovery for infrastructural services, enforced by the political and social processes, is an accepted social norm. Beneficiaries were required by institutional rules to bear a heavy burden of investment financing (about one half of the construction costs), but had the choice of service levels (either metered individual house connections or unmetered public taps). The selection criteria thus automatically weeded out communities not prepared to accept cost recovery responsibilities. Some Brazilian projects have well-administered metering and billing systems, and tariff defaulters automatically get their connections cut.

In a second group of countries, viz India, Pakistan and Philippines, the traditions are not the same. These projects adopted an activist government role in financing the capital cost of the water and sanitation project, while recognizing that beneficiary participation was essential for operation and maintenance. However, public officials, rather than beneficiaries, decided on service levels. Substantial software allocations were built into projects, and aimed at motivating and training communities to accept and internalise their operation and maintenance role. Clearly, however, the possibility of free rider problems and opportunism within community groups remain.

In a third group of countries, including Sri Lanka, Indonesia, Paraguay and other projects in Pakistan, and in other projects in Brazil, the attempt is to support communities so that in their self-interest they are likely to maintain constructed facilities. In the World Bank projects here, communities, rather than public officials, exercise final decisions on service levels; the professionals provide advisory support and technical assistance. Communities may also be required to contribute some cash toward construction costs, so that their equity interest is confirmed before construction. Training, participatory

methods and technical assistance are inputs designed primarily to facilitate community participation in decision making, rather than simply motivating householders to maintain the constructed facilities.

The project experience so far suggests that the robustness of a project design depends on the degree to which it maintains a demand focus, plus the extent to which public agencies have the institutional means of enforcing project rules on cost recovery. In the first group a 'strong' administrative capacity exists, and project managers have the institutional means of ensuring that communities and individuals honour their cost recovery commitments. In other groups, difficulties in enforcing project rules through State organisations are recognised, and the design choice is to rely either on motivating communities to enforce rules by themselves (second group), or through demand and incentives (third group).

In this third group, the principal objectives are twofold. Firstly, to verify whether demand exists at all, by actively involving beneficiaries in the scheme selection process. Secondly, by building in self-interest incentives to make the system work, to prevent moral hazard and free rider problems from emerging when beneficiaries are asked to pay for operation and maintenance of the system. (Jagannathan, World Bank, personal communication, 1994)

The engineering in this third group is designed to reinforce this self-interest. For example, the layout of sewerage is such as to ensure that a householder's neglect of routine cleaning may lead to one or both of -

- overflow within his own property
- overflow within the property of several neighbours, who will together apply "peer pressure" on him not to neglect his duties.

Either way, feedback to that householder on his neglect of his duties is "rapid, direct and informed". (Briscoe, World Bank, personal communication, 1994)

A Brazilian project, known as the Prosanear Project, is with Bank assistance already providing water and sanitation to hundreds of thousands of urban residents. A significant feature is some clever engineering, and the danger is that this clever engineering may be seen as "the system". However, where the community and organisational aspects have been missing, this same engineering has worked poorly or not at all. (Box 3.2; also Box 6.5)

Essential elements of the experience on finance are discussed in Sections 9.8 and 9.9 below, after the discussion of the experience in cost, price and affordability. How all the above is of relevance to South Africa is returned to and is more rigorously shown in Report no. 9 of this project series. Until then note that, as Rogerson observed in respect of urban management in a broader sense:

"... the success or failure of any urban policy interventions often is more crucially dependent upon local

circumstances than the inherent merits or shortcomings of the policies themselves. Therefore, in assessing the international experience of urbanisation one must be aware, for example, that the combination of work ethics, strong sense of community and obligation fostered by Confucianism is an important element in the 'success-story' of a whole array of different urban policy interventions within East Asia. Accordingly, the transfer of forms of policy intervention, which have proved successful in one particular societal framework, into a different kind of society will not necessarily bring forth the same successful outcomes." (Rogerson 1993, pp 139 and 139)

6.3 Chapter 6 conclusions

The conclusions are, briefly, that -

- an appropriate institutional, legislative and financial framework is essential for the success of water and sanitation programmes;
- institutional appropriateness particularly includes technical competence and efficiency at local level;
- shortfalls in urban services are often in large part due to shortfalls in financial capacity, which in turn is largely due to the poverty of the communities and the reducing levels of assistance from national government;
- Increasing reliance must be placed on user charges for services;
- private sector operation and maintenance of services (but not necessarily ownership) can be positive if the regulatory framework is well defined and is enforced;
- in many circumstances, NGOs and CBOs can take some responsibility for services;
- services provision, among other measures, contributes to the productivity of urban economies, and thereby to its own sustainability;
- it is necessary that potential beneficiaries are consulted as to their priorities in respect of both the product of infrastructure development and the process of acquiring it;
- a determined effort is necessary to ensure the participation of women in decision-making;
- capacity building of communities is necessary;
- personalities and political will can make or break a project;
- key participants, such as a programme champion, should be identified and nurtured;
- barriers to projects can include the psychological;
- revision of regulatory requirements is often necessary;
- hard budget constraints unlock incentives;
- few infrastructure agencies are efficient at all scales, from bulk services to the very local;
- evidence prior to capital investments in a project is often necessary as to whether beneficiaries will honour their promises to pay for system upkeep (i.e. they will not try to be "free riders"): alternatively, sufficiently robust incentives must be built into the service provision;
- in the above, much depends on the supplier's ability to bill for the service, local tradition of cost recovery, beneficiaries' perception of the likelihood of the penalising of defaulters, "ownership"

perceptions by the beneficiaries, and engineering design;

- World Bank opinion on prioritisation is swinging from the equity approach to an approach that improves the easiest situations, or those that can give greatest, leverage, first.

6.4 Notes on additional references

- Briscoe (Briscoe 1993) noted that a review of World Bank experience in water and sanitation pinpointed "institutional failure" as "the most frequent and persistent cause of poor performance". He listed and motivated the "at least seven key areas for institutional reform", viz -
  - improving utilities' performance
  - managing at the appropriate level
  - separating regulation and provision
  - expanding the private sector's role
  - increasing community involvement
  - creating an enabling environment
  - structured learning. (Briscoe, 1993, pp 29 - 36)

- For more on PSP, see -
  - Walker et al 1992
  - Walker 1993
  - Rondinelli and Kasarda 1993
  - Gidman 1995

- For more on institutional assessment and institutional frameworks, see -
  - Cullivan et al 1988
  - Tamm 1991
  - Katko 1992
  - Kessides 1993
  - Edwards et al 1993 (on decentralisation programmes)
  - Kessides 1993
  - Prud'homme 1994 (on the dangers in decentralisation)

- For more on community participation and management, see -
  - Yacoob and Rosensweig 1992
  - Cairncross 1992 (especially Chapter 2 on "organizing" and pp 45 - 47 of Chapter 4 on community-driven "inducements" and "compulsion")
  - Evans and Appleton 1993
  - Narayan 1993

- Srinivasan et al 1994
- Yacoob and Brantly ("work in progress") 1994 (on "community-based environmental management" programmes)
- Watson and Jagannathan 1994
- World Bank Environment Department 1995 (15) and (17)

- For more on capacity building and training, of communities, but also of professionals, see -
  - Pickford 1990
  - the training materials available from the International Training Network for Water and Waste Management of the UNDP - World Bank Water and Sanitation Program (early 1990s)
  - Okun and Lauria 1991
  - Alaerts et al 1991

- For more information on financing, see -
  - Dalton and Dowall 1991
  - Peterson 1991
  - Peterson, Kingsley and Telgarsky 1991
  - McCullough et al 1993
  - Briscoe and Garn 1994
  - Varley 1994 (particularly Chapter 4 "Case studies of credit for water supply and sanitation", and Chapter 5 "A typology of credit interventions").

Box 6.1 Private sector provision of urban water and sanitation

The menu for private sector participation (PSP) varies from ownership of assets to service contracts. The selected options should be tailored to specific country situations and city situations.

Four types of contracting arrangements are most commonly used in urban water systems: service contracts, management contracts, lease contracts and concessionaire contracts. As follows:

- With service contracts, a public water company hires a private firm to provide specific services such as reading meters, billing and collecting, and operating production facilities.

- A management contract lets a contractor assume overall responsibility for operating and maintaining the water supply system, with freedom to make day-to-day management decisions.

- Under a lease contract, a private firm rents the facilities from a public authority and assumes responsibility for operation and maintenance. The lessee finances working capital and replacement of capital components with a limited economic life, while the public authority is responsible for fixed assets.

- With concessionaire contracts, a private firm finances investments in fixed assets, in addition to working capital. Assets are owned by the firm for the period of the concession and are transferred back to the public authority at the end of this period. (World Bank Policy 1993, p110).

These arrangements are already observed in several developing countries and are designed to use competitive market forces to improve water management. Examples highlight the World Bank's support for privatisation in water supply systems.

In 1977 the Empresa Metropolitana de Obras Santarias (EMOS), the water utility for Santiago, Chile, began to encourage its employees to leave the company and form private firms that would bid for service contracts. Contracts were awarded for one to two years under competitive bidding for meter reading, maintenance of the pipe network, billing, vehicle leasing, and more. This approach reduced public employment and costs, shortened response time, and improved service. EMOS is now one of the most efficient public water supply companies in the region, as shown by the number of staff per head of population served. (World Bank 1993b, p110).

Among the factors that contributed to the success of arranging PSP in a 30-year concession for water and sewerage services in Buenos Aires, Argentina, were the active participation of top political figures in marketing the arrangement; the negotiation of a consensus among the key sector actors regarding the framework for the arrangement; the transparency that resulted from the participation of multilateral agencies and independent consultants; the establishment of adequate tariffs prior to the tendering process; and the mitigation of exchange rate risks. The case of PSP in Paris demonstrates how risks can be shared in a public-private partnership, and how competition between service operators can be structured. Consumer involvement in an important element of the regulatory framework reduces the need for bureaucratic regulation of services. Two cases from West Africa, Côte d'Ivoire and Guinea, illustrate how incentives for maintenance and good service can be incorporated into operational contracts, and that operators may be willing to assume greater commercial and investment risks over time.

(Triche 1990; Richard and Triche 1994; Triche, World Bank, personal communication, 1994)

Box 6.2 Two NGO success stories : offering credit to improve sanitation

A: CHF and UNICEF provide options for peri-urban sanitation

"In Honduras, the Cooperative Housing Foundation (CHF) and UNICEF hope to improve unhealthy sanitary conditions through a sanitation loan program for low-income families.

The program aims to increase interest in using credit to make sanitation improvements, and to raise awareness of the need for better environmental sanitation. Loans are available to participating families to build shower stalls, construct water storage tanks and wash stands, implement rooftop rainwater collecting systems, or make other improvements, such as devising an appropriate way to dispose of human excreta. People have the option of building alternatives to simple pit latrines, including ventilated improved pit (VIP) latrines, dry compost latrines, and pour-flush toilets. Loans also can be used to make a legal connection to a city's waterborne sewerage system when possible.

By offering a variety of options in a broader price range and linking them to well-managed credit programs, CHF and UNICEF hope to increase the demand for urban sanitation."

B: Grameen Bank : sanitation loans for the poor

The Grameen Bank has gained international acclaim for its novel approach to economic development and poverty reduction in Bangladesh - making small loans at commercial rates to groups of poor people in rural and peri-urban areas.

"Today, it has nearly one million borrowing members in over 24 000 communities; nine out of ten borrowers are women from families that are landless and without assets. Each individual who receives a loan must agree to the bank's "Sixteen Principles", one of which states, "We will not defecate in the open. We will use pit latrines." To date, more than 100 000 latrines have been financed. A subsidiary loan program also has been developed through which a latrine can be purchased with a US$14 loan repayable over a one-year period."

(Hogrewe, Joyce and Perez, 1993, p35)

Box 6.3 Do beneficiaries want the services? : Indonesia

Verifying whether projects provide services people want and are willing to pay for is the first normative standard on which project design can be assessed.

The following passage from a consultant's report during the preparation phase of an Indonesian project, although rural and not urban, illustrates the point:

> "An example was Klepu Kelis, a village in Lombok which refused to self-finance a water scheme even though they had to walk up to 5km to get water. The reason given was that work was largely seasonal, with much unemployment in the off months. In other words, the time saved had little economic value."

From a policy perspective, two interpretations of the above statement are possible.

The first is a welfare-maximising interpretation. If water is indeed a basic human need, the argument goes, public subsidisation of capital cost (and even of operation and maintenance costs) can be justified as a part of a national poverty alleviation strategy. The validity of this interpretation depends on the extent to which a national government can continue financing recurrent liabilities. In most developing countries this is unlikely to be the preferred option, because of their budgetary problems.

The second interpretation regards water as an economic good, the demand for which must be ascertained from beneficiaries. As long as beneficiaries base their decisions on what appear to be reasonable local priorities, the policy maker should respect their judgement. Using the perspective, villagers of Klepu Kelis appear to regard employment opportunities, rather than water and sanitation infrastructure, as their number one priority, and the focus of localised public investments should be toward employment creation first. Sectoral funds would be better served, from both a welfare and an efficiency maximisation point of view, if they were channelled toward many other villages where demand for water and sanitation infrastructure was perceived as the highest priority.

(Jagannathan, World Bank, personal communication, 1994)

Box 6.4 Incentives for householders to instal improved sanitation

"However effective the health education methods used, few householders beyond a small minority of pioneers are likely to install a new latrine purely on the advice of strangers. Most people need peer pressure and support. For this reason there are advantages in a promotion system which mobilizes prominent community residents, such as Community Health Workers, officers of the local residents' association, women's organization, political party, or other volunteers, to spread the word among their friends and neighbors.

More powerful than persuasion or exhortation is the strength of example. Any cadre of promotion workers, whether trained professionals or local volunteers, must be seen to own and use sanitation facilities, preferably of the type they are promoting, if their words are to be taken seriously. This has the added advantage of allowing local residents the chance to inspect one of the latrines at first hand, and also to discuss its costs, use and maintenance with the owners.

Demonstration and exhortation have limitations. Their effects can take time to have an impact as the idea of improved sanitation starts to catch on in the community, and it can be many years before ownership of a latrine becomes the social norm. Inducements are often used to speed up the process. The simplest and most common of these is to subsidize the cost of construction ... it was pointed out that in some cases [subsidies] can be a constraint to program implementation and growth, and their use to speed implementation could be self-defeating.

There are other forms of inducement. Lottery tickets, for example, are popular and inexpensive. One approach that has been used in rural programs from Guatemala to Bangladesh is to link sanitation with water supply and make it a condition that a community install latrines for a set percentage of households before it can qualify for subsidized water supply. There is a danger, however, in using incentives that are not directly related to sanitation. There have been cases of such sanitation-water linkages where there was no perceived need for sanitation in the population, who built latrines on sufferance with a view to obtaining a water supply, but did not use them or maintain them adequately ...

In a community where only a minority of households have adequate sanitation facilities, compulsion is unlikely to change the situation very much. Part of the problem is that building regulations of many developing countries are irrelevant to the needs of low-income groups. There is no doubt some virtue in making them less so by adapting them to embrace on-site sanitation systems and local low-cost building materials. Most useful of all, though, is to make them more useable by writing them in the form of guidelines and manuals rather than legal prohibitions, and applying them by offering technical guidance and support rather than by policing their enforcement.

Nevertheless there are two sets of circumstances in which some form of compulsion may help to ensure a high degree of coverage of a community with sanitation facilities. It can be argued that a high coverage level is necessary if sanitation is to be of benefit to the community's health because the fecal pollution caused by a minority of nonusers is sufficient to jeopardize the health of all their neighbors.

continued

The first case is where anyone wishing to erect a house in an area of new construction is first obliged to install a latrine ... In the urban site and services schemes in Botswana, each plotholder has to complete the latrine superstructure within three months from occupation of the site and before starting to build the house.

The other case is the consolidation phase of a sanitation program, in which the majority of households already own a latrine and sanitation has become the social norm. Compulsion, reinforced by the power of peer-group pressure, may then help ensure that the remaining minority conforms to that norm. Here too, the compulsion must be an expression of the values of the community, rather than coercion from outside, or the residents will not accept the authority of those who impose it and will probably seek to evade it. If the compulsion is visibly an expression of the will of the community, members of the community will themselves apply pressure to those who do not comply."

(Cairncross 1992, pp45 - 47)

Box 6.5 Meeting the demand for sanitation services: the *favelas* of Sao Paulo

"In the 1980s the Brazilian city of Sao Paulo made extraordinary progress in providing all its residents with water supply and sanitation services. In 1980 just 32 percent of the *favelas* (low-income informal settlements) had a piped water supply, and less than 1 percent had a sewerage system. By 1990 the respective figures were 99 percent and 15 percent!

SABESP, the state water utility serving Sao Paulo, is a technically sophisticated water supply organization. Until the emergence of democracy in Brazil, SABESP had defined its role narrowly and technocratically. Specifically, it did not consider provision of services to the *favelas* to be its responsibility because it was not able to do this according to its prescribed technical standards and because the *favelas* were not "legal", and it resisted pressures to provide services to the settlements. Meanwhile, a small municipal agency (COBES) was experimenting with new technical and institutional ways of providing water and sanitation services to the poor. On the technical side this did not involve provision of inferior service but reduction of the cost of providing in-house services by using plastic pipe and servicing narrow roads where access was limited. On the institutional side the community had to assume significant responsibility for community relations and for supervising the work of the contractors.

As the military regime withdrew and was replaced by democratic politics in the early 1980s, the pressures on SABESP to serve the *favelas* increased. Community pressure was channelled through the municipal agencies and responsive officials and politicians, including the mayor and governor. Since COBES had shown how it was, in fact, possible to serve the *favelas*, SABESP had no option but to respond.

The lessons from Sao Paulo are twofold. First, that once the poor have water services, a strong demand for sanitation services naturally emerges. Second, where institutions are responsive and innovative, major gains can be made in the provision of these services at full cost to poor people."

(Serageldin 1994, p9).

TABLE 6.1 INNOVATIONS IN INSTITUTIONAL ARRANGEMENTS

	Philippines I	China I	Pakistan	India	Philippines II	Paraguay	Sri Lanka	Indonesia	Brazil
INNOVATION IN INSTITUTIONAL ARRANGEMENTS	• Community Associations (Rural Waterworks and Sanitation Associations) to undertake operation and maintenance responsibilities • Less than 25% of communities formed RWSAs • Establishment of a Program Implementation Review Committee (PIRC) for oversight	• Organized and managed by existing village level institutions (communes) • National Project Office monitored achievement of project milestones	• Mobilization of communities through training and extension • Memorandum of Understanding signed with communities sets up a water users association • Establishment of a Policy Investment Review Committee at the national level for monitoring project performance	• Management by local government institutions (Panchayats) • NGOs given a role. Design of demonstration projects for sanitation • Project Planning and Monitoring Unit (PPMU) set up for monitoring and evaluation	• Community organizers from Local Govt. Department to mobilize communities • NGOs to provide training to Community Associations (BWSAs) formed to undertake operation and maintenance responsibilities • Project Coordination Committee (PCC) for monitoring and evaluation	• Juntas or Community organisations to assume operation and maintenance responsibilities, and recover costs from beneficiaries • SANESA (State Water company) executes project and provides technical assistance	• Community based informal organisations to select options, manage systems • Technical Assistance in preparing W&S scheme by partner organization (NGO, local govt, etc) • Project monitoring and evaluation function managed at national level by international consultant	• Village Water and Sanitation Committee organized for community management within local govt. framework • NGOs assist VWSCs prepare Village Action Plan, train members for Operation and maintenance functions • Training in participatory techniques for officials to become responsive to community needs • Monitoring and evaluation and feedback system at national and provincial levels	• Monitoring and evaluation cell with National executing agency, CEF • Different cities adopt different arrangements for presentation of technical options, usually through design consultants consisting of engineers and social workers • Communities encouraged to utilize informal associations for design selection and service levels
Evaluation and feedback mechanisms	• PIRC non-functional	• Oversight by county governments	• Mid-term project review three years after project commencement to modify/alter project designs	• 'Milestones' monitoring by PPMU	• Monitoring by PCC	• Monitoring by SANESA	• Project Review process according to set criteria, in which lessons learned are fed back to improve design	• 'Programmatic' approach in which each year's experience is used to modify/alter subsequent year designs	• Lessons learned are being documented to improve future projects targeted at low income communities

(Jagannathan, World Bank, Internal Memorandum, 1994)

7. EXPERIENCE IN ECONOMIC ISSUES

7.1 Chapter 7 introduction

Chapter 7 describes and examines experience in economic issues. Chapter 8 describes and examines experience in environmental and social issues. The division of subject matter between the two chapters is somewhat arbitrary, and is done on the grounds of convenience, but broadly:

- Chapter 7 deals with -
  - the need for economic analysis (Section 7.3)
  - costs of insufficient water and sanitation services and of poor health (Section 7.4)
  - employment and entrepreneurial opportunities in water and sanitation (Section 7.5)
  - leverage of investment in water and sanitation (Section 7.6)
  - allocating the costs and distributing the benefits of water and sanitation services (Section 7.7).

- Chapter 8 deals with -
  - the context of environmental and social issues
  - perceptions of "the environment"
  - impacts on biophysical environment
  - environmental health impacts
  - social issues, including cultural issues, community involvement, community preference, and the role of women
  - environmental legislation.

Section 7.2 serves as an introduction to the material that is common to both chapters.

7.2 Costs of, and opportunities in, water quality, health and the environment

"Countries have generally paid too little attention to water quality and pollution control. In many developing countries, water supplies are of poor quality and often unsafe for human consumption. Using polluted waters for human consumption is the principal cause of many health problems such as diarrhea diseases, which kill more than 3 million people each year - mostly children - and render sick more than a billion more. In addition to human suffering, water pollution causes devastating economic and environmental damage. Inadequately treated sewage aggravates poverty by polluting water-dependent food sources, engendering disease, and limiting access to safe drinking water. Furthermore, water-related diseases such as malaria, filariasis and onchocerciasis are common in

Sub-Saharan Africa. They are caused not by water pollution but by inadequate water management, poor hygiene, and a lack of adequate public health education. These diseases have a debilitating impact on people and significant, negative consequences on productivity, particularly in the rural areas. The discharge of untreated industrial waste, the runoff of agricultural chemicals, and poor land use practices in agriculture, forestry, and mining cause wide-spread degradation of land and water resources." (World Bank 1993b, p32)

On the positive side, there are employment and entrepreneurial opportunities in the provision of water and sanitation. Direct employment creation strategies that could be sustainable include public works programmes, and community-based approaches to operation and maintenance.

7.3 The need for economic analysis

Brookshire and Whittington have made a compelling argument for economic analyses.

"Many of the water projects built in developing countries over the last 25 years have been failures . For a variety of reasons, many water schemes do not live up to expectations. In urban areas water projects often fail to achieve the performance anticipated in terms of water sales, number of connections, and the proportion of costs recovered. .... in rural areas many people [are] supposedly "served" by new water facilities [but which] are not used and are abandoned.

Different disciplines have offered various explanations for the lack of success of so many water supply investments. Public health professional cite people's lack of knowledge of the health benefits of improved water supplies. Financial analysts doubt whether proposed tariffs are affordable. Anthropologists content that project failure arises from donors' and central government planners' insensitivity to local customs and beliefs. Engineers point to a lack of technical expertise and an inability to operate and maintain water systems once they are in place. Many people believe that the lack of community participation and local involvement in design and management is a major cause of project failure.

One of the principal problems has been the lack of sound economic analysis prior to project design and construction. ... This lack of economic appraisal of water projects has occurred for two basic reasons. First, in many cases improved water supplies are a very high priority for communities. People do not need it explained to them by professionals that without water, they can only live for at most a few days. Both governments and opposition parties have often responded to this grassroots demand for improved water by asserting that access to water is a basic human right, and it is the government's responsibility to see that all citizens are supplied with clean, and sufficient supplies of water.....

The problem formulation implicit in this view is to minimise the costs of providing service to all, subject to the constraint that everyone is served at some minimal level. The argument runs along the lines that water is the "basis of life" and is "beyond price". Essentially, there is no choice criteria in choosing which projects to build and the types of projects to build. To many, efforts to look at the costs and benefits of various alternative water supply projects seem to be an unnecessary academic exercise, simply an hindrance to work that obviously needs to be done. ....

As such, a central problem in developing countries is the type and choice of projects. ... [some] argue this is a front end problem whereby the incentives appear to be to build a "monument" and move on to another project. ... [Thus the second basic reason for the lack of economic appraisal] is that given the nature of the existing institutions, the net effect of the process is the selection of capital-intensive projects and the neglect of good maintenance programmes. While some might argue that the solution to such a problem is the privatisation of the institutions, they suggest that the answer lies in better accountability." (Brookshire and Whittington 1993, p1883-1885)

Thus, typically, in choosing which projects to pursue, there is no serious quantification of benefits and thus appropriate comparisons between alternative projects are not made. The lack of quantification of benefits is justified on the basis that water is essential, and thus any project must be justifiable. Finally, financial, equity, and health issues are often not carefully considered in the project feasibility process.

Although improved analyses can help avoid some planning mistakes, there are other important dimensions to the policy quagmire faced by developing countries. One of the most vexing problems has been the inability of water resource and sanitation professionals to think creatively about the nature of institutions. These professionals often have a vision of what an ideally managed water resource system would look like. The normative underpinnings of this vision are found in welfare economics. Investments would be made in reservoirs and water distribution infrastructures so that "benefits" to people would be maximised. Water would be allocated to its "most valuable" uses, but everyone would be supplied with enough water to meet their "basic needs" at an affordable, perhaps subsidised, price. Otherwise, prices would be set so that water users would face the real marginal cost of supply and effluent discharge.

It is the contrast between this vision and the existing state of affairs that defines the problem. Since the use of water in one part of the hydrologic cycle often had obvious and important implications for uses elsewhere, water resources professionals seeking to understand and solve water resources problems have felt a compelling need to take an integrated, comprehensive view of the cycle and man's interactions with it. This systems thinking has led to a powerful and intellectually appealing

concept of integrated water resources management. Stripped of its institutional content, at its most basic level, this concept is a multi-objective optimisation model. All of this is understood in varying levels of specificity by only a small number of engineers, economists, planners and systems analysts in developed countries - but in developing countries this number is minuscule.

For most professionals this optimisation framework remains a somewhat amorphous set of concepts tied together by the notion that water resources planning should be "integrated" and "comprehensive." There is, in fact, a huge gap between the concept of the integrated water resources planning approach and how most water resources planning is actually done and what needs to be done. In practice, most planning is done incrementally and is driven by the need to find solutions to relatively immediate and specific problems.

Furthermore, ".... the fact that governments and donor organisations have defined water as a basic right, and that it is difficult to value the benefits of improved water supplies in both physical and monetary terms (particularly the health benefits), has contributed to a culture in which attempts at systematically analysing the economic benefits of investment projects are viewed with suspicion. Not only is benefit analysis avoided, but are most attempts at rigorously evaluating the outcomes of investments in water supply projects.

For the great majority of recent World Bank-financed water supply projects, no attempt was made to estimate the socio-economic benefits of the investment. For urban projects the standard practice is to carry out a financial analysis in which the benefits of the project are presumed to be the revenues from water sales. However, because water prices are often subsidised for social reasons, financial rates of return on water projects are typically low, and projects must be justified on other grounds.

For rural water supply projects the World Bank almost never attempts to estimate economic benefits but instead alludes to "unquantifiable" benefits to justify projects. Similarly, neither the United States Agency for International Development nor the Asian Development Bank make any effort to estimate the economic benefits of water supply investments, nor do they have any guidelines or standard procedures for the economic appraisal of water supply projects. .....

As mentioned, the conventional wisdom has been that since everyone "needs" a safe and reliable water supply, central governments and donors cannot really make a mistake in selecting a site for a new water supply project. This reasoning, however, neglects two important facts. First, investment funds are limited, and even is all potential projects could pass a cost-benefit test, one should still try to allocate investments to the places where net benefits are greatest. Second, investment projects require that decisions be made not only on location, but also the level of service to be provided and

on the price(s) to be charged. Sometimes overly ambitious, "high-technology" solutions to problems are proposed and implemented when similar, low-cost alternatives would have been more appropriate. However, it also happens that "low-tech" solutions are provided when people desire a higher level of service. In both cases the technology selected is inappropriate, and soon facilities are underutilised." (Brookshire and Whittington 1993, p1885 and 1886)

Note: The issue of the valuation consumers place on water and sanitation and, derived therefrom, the price they are willing to pay (subject to affordability constraints), is dealt with in Chapter 9.

Brookshire and Whittington continued: "A missing link in the discussion thus far is a consideration of three subtopics: rent seeking, equity and health. The question of whether the institutional arrangements provide incentives for the technical specialists or the decision makers to understand or advance the interests of the other stakeholders or groups is rarely asked. It is well-known, for example, that the demand for water in many cases is quite inelastic over a wide range of quantities. There is no substitute for water in irrigation and arid areas (although there are of course water-saving irrigation technologies and possibilities to change crop mix). Also, people must have minimal amounts of water in some form to survive, and there is compelling evidence from developing countries all over the world that households often pay extraordinarily high prices to water vendors for small amounts of water. Not only is the demand for water inelastic, but the supply is often centrally allocated and managed. Indeed, this is precisely what the integrated water resources planning approach recommends. Given this situation, an obvious strategy for rent-extracting agents would be to gain control of water sources, restrict supply to users, and then raise the price of water.

Rent-extracting behaviour is not limited to municipal water systems as the supply of irrigation water also provides particularly rich opportunities for such behaviour by agents operating the distribution network. There is even evidence of monopoly pricing in the sanitation sector. The water resources investment program is another area where economic rents can be appropriated. Large publicly financed investments often result in large gains and losses for different groups and are typically the focus of intense political activity. It should not be surprising that this happens in developing countries; it has been a defining characteristic of federal water policy in the United States for decades. Indeed, water projects are viewed as the quintessential "pork barrel" projects.

These realities suggest that more research and analysis needs to be done on the design of institutions and the structuring of incentives to control or destroy possibilities for rent-extracting behaviour by agents in the water sector.

Policies are needed that offer realistic possibilities of harnessing market forces to promote economic

efficiency and equity. The promotion of such policies is a difficult undertaking for both multilateral and bilateral donors and is by its nature highly politicised.

Donor assistance in water resources planning and management should thus foster citizen involvement in water resources planning decisions and local control of water utilities. Water resource planners often lament "fragmented" decision making and the lack of a basin-wide perspective, and often use the "integrated water resources planning" paradigm to argue for increasing centralisation of decision making authority with ever broader responsibilities. Yet the current literature on the effectiveness of public sector institutions is quite clear; the institutions that work well are those with clearly defined missions and those whose outputs and performance can be measured. Innovative thinking is needed to design institutions that balance (1) the benefits of a comprehensive planning approach and (2) needs for local participation and control." (Brookshire and Whittington 1993, pp1886 and 1886)

Taking the above theme further, Fass stated that the frequent failure to account for intangible benefits associated with water supply improvements may lead to underestimation of returns to investment and therefore to economically inefficient investment. He questioned the focus of developing countries on equity in regard to low-income consumers, and argued that other issues such as health and labour productivity are equally important.

"Planning of urban water supply systems in developing countries usually addresses two issues: efficiency, from the perspective of the water supply agency and of the society as a whole, and fairness or equity. Water prices should be, and should remain, affordable to low-income people. Even if appropriate prices are obtained at some loss of economic efficiency, this population should be able to consume adequate quantities of safe water without onerous expenses of money or time. From this perspective efficiency is to be achieved through marginal cost pricing. Social benefits are estimated from shadow pricing the incremental gains to health that come from improvements in water quality and time savings that derive from improved access to sources of supply, and equity is achieved through price subsidies.

Useful as this framework may be, in applying it planners often overlook certain aspects of water supply and pricing that may considerably affect both efficiency and equity and that may blur the boundaries between the two. Some tangible benefits may arise from improvements that extend beyond time savings and increased safety. For instance, water is essential to nutrition because (aside from its primary function as what people drink) it is the medium through which staple cereals and tubers are transformed into consumable food. It is similarly essential to inexpensive housing because it is a bonding agent in cement construction, and to residential density because water services shape the primary skeleton of urban spatial growth. Through these functions the price of

water, not just its safety and accessibility, may exercise other direct and indirect influences on health; and to the extent that the price of water influences health, it also affects the availability of labor, labor productivity at work, the share of family resources invested in fixed and working capital of household enterprises, and other items that affect household earnings.

Many other things and their prices affect health and income. However, water and its price may be especially important where prices for basic needs are high relative to income, where spending large shares of income yields very meager supplies of water, food and shelter, and where income derives primarily from self-employment in what is sometimes called the "informal sector". The relative importance of water in these relationships will vary, but that such relationships exist should be obvious. Yet references to them are most noticeable by their absence. ... This suggests that improvements to water supply [are regarded as not providing] tangible benefits beyond improved safety and time savings.

... I suggest that this absence of discussion about the relationship between water, nutrition, housing and health is indeed a serious oversight, and that in cases of extreme poverty this may lead to underestimation of the social benefits from improvements to supply. Failure to account for the ..." fuller range of tangible benefits associated with improvements in water supply may lead to underestimation of returns to investment and therefore to economically inefficient investment." (Fass 1993, p1975)

7.4 Costs, on productivity, of insufficient water and sanitation services and of poor health

The costs of the consequences of insufficient water and sanitation services that are more calculable in that they can be measured by formal market transactions (eg. the construction cost of a project, the sale value for a crop, or the medical cost of treatment of an epidemic), are often the only cost component of an economic analysis. For example, "... in Peru, more than 1000 people died from cholera, and losses in agricultural exports and tourism revenues were estimated at close to $1 billion. In 1991, polluted water from Amman's poor sewage works and industrial effluents severely damaged 6000 hectares of land downriver used for irrigating vegetable crops. In Columbia, cleaning up the Bogota River would cost an estimated $1.4 billion. In Shanghai, the cost of moving intakes upstream, because of pollution, is $300 million while in Lima, upstream pollution of the Rimac River has increased treatment costs by 30 percent" (World Bank 1993b, p33)

However, there are three other types of consequences, the costs of which are seldom taken into account.

The first is that, as the World Bank has admitted, that the economic analysis of their investment projects are often focused on the costs and benefits in one sector alone, and costs that may be thrown onto other sectors are not taken into account.

Even the costs of a sector as intimately linked to water as sanitation have not been taken into account in some water schemes. "Although funding for water supply projects receives attention, too often adequate sanitation does not. Large amounts of new water are brought into urban areas, which creates large amounts of untreated, polluted wastewater that is often used by the urban poor. This not only perpetuates disease but also creates larger environmental problems downriver, especially when sanitation projects include only the collection of sewage without adequate treatment. ...

A recent review of the World Bank's experience with 120 water supply and sanitation projects found that, while 104 projects funded water supply, only 58 included a sanitation component. Also sanitation components within projects were often eliminated because of cost overruns. In only a few of the cities with Bank-financed water supply projects was adequate sewer or sanitation provided to handle the increased wastewater created by the project. The review concluded that the Bank and its borrowers have not adequately invested in the removal and treatment of sewage. Diseases will continue to spread among the poor, and the economic and environmental deterioration will continue until adequate wastewater disposal accompanies the provision of water." (World Bank 1993b, p33)

The second type of consequence is that the costs of insufficient water and sanitation, and indeed of others of what are often termed "environmental disasters", such as floods or the effects of industrial spills in the urban watercourses, are disproportionately borne.

Satterthwaite referred to the "geography of inequality":

"If there was sufficient information available to construct a map of a city, showing the level of risk from environmental hazards in each neighbourhood, the areas with the highest risks would coincide with the areas with a predominance of low-income groups. In most Third World cities, the correlations between income levels and environmental hazards would be particularly strong with respect to the quality and quantity of water, the level of provision for sanitation, drainage and solid waste collection, and the risk from floods, landslides and other natural hazards. The reason for this is simply that poorer groups are priced out of safe, well-located, well-serviced housing and land sites. In many cities, there will be a strong correlation between indoor air quality and income because poorer groups use more polluting fuels and more inefficient stoves (or open fires) which

ensure a much worse air quality indoors. The fact that poorer groups also live in more overcrowded conditions exacerbates this and the transmission of infectious diseases. A high proportion of poor groups live in shacks made of flammable material, with higher risks of accidental fires. Poorer groups will generally have the least access to play-grounds, parks and other open spaces managed for public use. The correlations between income level and level of air pollution may not be so precise. In certain "hot spots" such as close to quarries, cement works and industries with higher levels of air pollution in their immediate surroundings, the correlation is likely to be strong. But the correlations are less clear when an entire city suffers from air pollution.

... Ironically, dangerous or polluted land sites often serve poorer groups well. For these are the only sites, well-located with regard to income-earning opportunities, on which they have some possibility of living (illegally) because environmental hazards make the sites unattractive to other potential users. ....

The economic underpinning of environmental hazards becomes clear when comparing the hazards faced by the poorer groups with those faced by richer groups. Most studies on communicable diseases and morbidity and mortality show that the most vulnerable group are predominantly the poor - be they children, adults in crowded unhygienic conditions or workers in particular occupations. Low-income groups are the least able to afford the homes that protect against environmental hazards e.g. good quality housing in neighbourhoods with piped water and adequate provision for sanitation, garbage collection, paved roads and drains. In addition, higher-income groups will generally have less dangerous jobs and work in occupations where occupational hazards are minimised.

Low-income households are also more vulnerable because they lack the buffers to cope with illness or injury. Low-income individuals / households generally have most difficulty in getting treatment for any injury or illness - for instance emergency services in the case of a serious accident and treatment from a health centre or hospital. They have the least means to afford medicines and (generally) the least possibility of taking time off to allow recovery because the loss of income from doing so would press heavily on their survival, and because they are unable to afford health insurance. ..." (Satterthwaite 1993, pp102-104)

Thus, vulnerability is also linked to a lack of means both to avoid an environmental hazard (including insufficient water and sanitation) and to cope with its impact. (See Box 7.1.)

The third type of consequence is the effect on personal productivity and wage-earning of insufficient

water and sanitation, or of increase in cost of these. This is most graphically illustrated by the effect on those who are "ultra poor" (Fass 1993 p1977).

Loss of time (to cope with illnesses, or a natural disaster), or increases in cost of water, for example, "... meant that opportunity costs associated with marginal increases in expenditure for any one item, water or whatever, would usually include not only the value of forgone consumption of other items but also the value of forgone production and earnings that might result from a lowering of labor productivity. ... People in this circumstance have such low income that they run considerable risk of severe and chronic malnutrition, which, through its impact on health and thus on labor productivity, may lower earnings even further and threaten household survival altogether." (Fass 1993, pp1977 and 1978)

"As some studies suggest that increases of 25% over base levels of 2400 calories can raise labor output by up to 45% in certain occupations, it seems reasonable to suppose that producing sizable increases over levels of 1500 calories [which is a not untypical intake for the ultra poor adult] might yield even greater returns in improved labor output via increased strength and endurance and improved general health and mental alertness.

.....Any decline in the physiological or mental capacity of wage employees paid piecework rates, or of traders and manufacturers who need strength and alertness to compete effectively, could depress earnings. Any appreciable drop in [already low] individual monthly income could seriously undermine the welfare of the entire household. Time lost to illness or to caring for the sick, where a day "off" meant a 15% loss in weekly earnings and where further resources might be sacrificed to pay medical fees, could seriously compromise family income, possibly reducing food intake and leaving the household more susceptible to further sickness, and to that downward spiral into absolute destitution that a great many were already struggling to avoid." (Fass 1993, p1979)

None of this is specific to water. However, it is the experience of Fass and others that failure to account for the larger effects that water can have on health and income may lead to underestimation of the socioeconomic benefits of improvements and to corresponding underinvestment in such improvements.

7.5 Employment and entrepreneurial opportunities in water and sanitation

Kessides "summarized .... the issues and evidence" on employment generation and asset creation relating to "public works schemes", defined as "labour-intensive projects financed by public

reserves."

"Public works programs in theory have an impact on employment and incomes both in the short term (construction stage), and in the longer term (from the operation of the assets). In evaluating such programs, the effects in both stages need to be considered, and compared to the benefits the economy would have gained from the alternative uses of the resources (labour and capital) absorbed by the public works projects. Where such programs are financed by incremental and concessional foreign aid which does not substitute for other foreign funding or divert domestic savings for debt service, public works can be considered to create additional assets in the economy, although the quality (returns) to the investment still need to be demonstrated. Where they are financed by general tax revenues, or taxes which are regressive (hitting the poor harder than the rich), they can crowd-out more productive investments and can even have negative redistributive effects.....

The review of past experience with the variety of public works programs in developing countries suggests the following conclusions and lessons of interest for infrastructure policy. First, public works programs can be effective in generating significant amounts of short-term employment and income transfer where these are important policy objectives. However, the extent of their broader economic impact in terms of stimulating domestic demand in the surrounding economy, influencing structural unemployment, or increasing incomes and employment in the longer term are more questionable. Regarding the trade-off between short-term and longer-term benefits, the infrastructure is clearly of higher quality when projects are designed and selected to produce the highest economic returns, not to maximize employment during construction. The projects should be integrated into other development programs of the local area to generate the greatest benefit, and public works alone cannot be expected to create employment and income in the post-construction phase in regions which do not have development potential. To ensure that projects meet effective demand, beneficiary communities should identify and contribute to the costs of investment as much as possible, and should take responsibility for financing operation and maintenance. User charges, where feasible, are the most efficient and equitable means of financing [operation and maintenance] of public works (although rarely a feature of such programs in past experience.)" (Kessides, 1993, pp 30 & 32.)

There are encouraging case studies that demonstrate that the utilisation of community labour for the upgrading, operation and maintenance of their own services is arguably the most significant and cost-effective contribution that a low-income community can make to urban services development. (Box 3.2; Box 5.3; Box 5.4.) These do not contradict the above. They do however illustrate the

argument in favour of a "public works" programme at a very local level, where the benefits in terms of both reduced cost and increased income are apparent and direct.

7.6 Leverage of investment in water and sanitation

Schwartz and Johnson comprehensively reviewed the economic gains from investment in water supply and sanitation. They accepted the validity of research that demonstrated, in respect of domestic water and sanitation improvement, -

- the health and social benefits
- the gains for the economy for the improved productivity of healthier workers
- that this investment frees up the time spent by individuals collecting and carrying water, time that has an economic value for them however they might choose to use it.

However, despite commerce and industry being a larger user in the urban areas of developing countries than the domestic sector is, and that it is "..... closely related to the level of economic development,..... there has been little systematic identification of the gains to the productive enterprise and the economy as a whole [due to water and sanitation investment for the commercial and industrial sectors], or of the conditions under which these gains might or might not be expected to occur. Understanding these conditions is critical in water supply and sanitation project design, investment choices, and selection of financing alternatives.

Economic theory suggests that if investments in water and sanitation lead to lower input costs for firms using these services, these firms will respond with some combination of -

- expanded production and employment
- reduced prices; and
- investment of savings in other economic activities.

The first two responses exploit the availability of cheaper services; the third diverts savings to other activities and may not necessarily benefit the country or region in which the water and sanitation investments have been made if the beneficiaries transfer the savings to other regions or countries.....

Economies of scale, density economies, and technical efficiency are the means by which reduced costs are achieved. They all act to lower the unit cost of production of water and sanitation services, which then either are passed on to the purchasers of water and sanitation services as a

gain, or are retained by the water and sanitation producer for expanding production or for investing in other economic opportunities.....

This report focuses on the linkage between water and sanitation investments and economic growth rather than better health or the saving of time." (Schwartz and Johnson 1992, pp 1& 2.)

Figure 7.1 depicts the potential economic benefits from water supply and sanitation investments, "....including the saving of time by individuals and households, improved health, and impacts at the firm, industry and national levels.

The report discusses water supply and sanitation together, although the demand for the two services varies considerably from country to country. Whereas a water supply is *known* to be necessary for commercial and industrial activity, sanitation services are not always *perceived* by consumers to be essential. They often are provided as a regulatory or public health and safety measure. However, once they are in place, the same conditions hold as for economic gains from investment in water supply. In fact, the gains may be even greater.

Another point in the relationship between water supply and sanitation is that an increased water supply could necessitate additional investment in treatment and/or disposal facilities, or could increase costs in the form of environmental degradation." (Schwartz and Johnson, 1992, pp 4 & 5.)

Schwartz and Johnson concluded: "The economic impact of water supply investments will be greatest [ie. the leverage of investment will be greatest] in large and growing urban and peri-urban areas because -

- there is greater water demand by existing commercial and industrial users;
- there is a greater potential for new commercial and industrial users of water to start business;
- the necessary infrastructure (roads, electricity, communication network) to support new commercial and industrial development is likely to be in place;
- the concentration of economic activity in developing countries is shifting from rural to urban areas;
- small new firms are "incubated" in central cities;
- there is a larger potential market for goods and services that rely on water as an input in the production process; and
- the labor force and the demand for goods and services is growing as a result of rural migration.

The impact of water supply investments will be greatest where expansion will effect significant economies. This is most likely where -

- the capacity of the current system is relatively small;
- the distribution system can easily be expanded to increase coverage to commercial and industrial areas without exceeding current capacity; and
- the price of present supplies, either from the current system, vendors, or other sources, is higher than what the investment can promise.

Firms dependent on water to produce goods and services and therefore most likely to reward water supply investments are -

- small-scale home industries such as food preparation for street vending;
- microenterprises, especially tanning and dyeing;
- large-scale fabric and leather industries;
- breweries;
- construction companies; and
- industries that require large quantities of water for cooling and cleaning." (Schwartz and Johnson, 1992, pp 27 & 28.)

Kessides summarised an extensive literature survey on the economic effects of leverage in infrastructure investment as follows:

"The preceding discussion suggests that infrastructure policy involves high stakes for developing economies: there are multiple benefits to be gained, but likewise high potential costs (economic and financial) from mistakes in these sectors. A number of conditions appear necessary for infrastructure to have the favorable impacts on economic development described above.

As a first and basic condition, there should be a macroeconomic policy climate which is favourable to efficient allocation of resources. it is particularly important to avoid pricing rigidities in factor and goods markets so that infrastructure draws other resources to productive activities and does not crowd out more attractive investments. Macroeconomic policy issues such as inappropriate budgetary subsidies of infrastructure and distortions in financial and foreign exchange markets can seriously handicap the sectors' access to financing and undermine incentives for efficiency.....

Second, infrastructure projects can only raise the productivity of other resources when there is a sufficient complement and basic productive level of other resources. Infrastructure investments cannot create economic potential, only help develop it. ....

Third, infrastructure having the most significant and durable benefits to both productivity and consumption is that which provides the degree of reliability and quality of services needed by users.

.... The policy regime must also create incentives for efficient operation of infrastructure and accountability to users.....

Finally, infrastructure is likely to be more economically efficient, and have favorable impacts on the environment, when it is subject to user charges based (as much as possible) on (i) the marginal costs of supply, and (ii) willingness to pay. In order to obtain the greatest benefits from infrastructure's ability to raise the returns to other factors of production, resources for infrastructure should be priced to reflect their scarcity value (eg, the cost of capital used in financing projects should be realistic.) User charges are necessary to elicit expressions of effective demand, and to discourage wasteful consumption of infrastructure services. The absence of user charges has often not promoted effective access to services by the poor, but rather reduced both quality and availability and worsened inequities.

There are four main implications of the above analysis. The first is that investments should be based on analysis of the nature of demand for specific services, not on quantitative projections of physical "need". The latter approach involves calculations of investment requirements based on assumed coefficients of the capacity utilization of facilities, and estimates of future consumption of services without reference to prices. The design of a demand-based strategy for infrastructure policy imposes additional information requirements. It must entail analysis of the underlying determinants of demand, such as the composition of user groups and their demand for specific kinds of services (which depend, for example, on price elasticities), and the patterns of congestion .....

The second implication, which is complimentary to the demand assessment, is that the planning of supply should take account of all possible alternatives to generate the flow of services demanded - including measures (with or without investment) to increase the efficiency of existing facilities and relieve specific congestion points; to promote conservation options (reducing demand); as well as projects to create additional capacity. This investigation should involve a survey of how potential users of a new investment are currently being serviced, even by informal or illegal channels which may be exploited in designing future supplies. Such an approach in many cases would have prevented countries from making new investments which could have been avoided or delayed by efforts to manage better the existing facilities and/or the demand itself. .....

Thirdly, choosing between potential investments within infrastructure, or between infrastructure and other sectors, is best done with the traditional tools of benefit-cost (rate of return analysis). The trends in economic rates of return (ERRs) for World Bank infrastructure projects..... range from averages of 7 - 10 percent in water supply and sanitation to over 20 percent in transport and telecommunications.....

It should be noted that in the power, telecommunications, and water supply sectors, cost-benefit analysis uses revenues or actual tariffs rather than economic prices, and this is not a true measure of economic returns. [Under-pricing is misleading the calculation of ERR, which should therefore be higher.] Moreover, the recalculated ERR is based on actual costs but still projections of benefits; when it is recalculated a number of years after project completion, the results are sometimes less encouraging, particularly where there are institutional problems affecting the project. For a more accurate evaluation of proposed investments, it is necessary for benefits to be determined on the basis of demand assessments which include some estimation of economic prices, such as willingness to pay..... In addition, the indirect benefits and costs which infrastructure investments entail, such as impacts on adjoining land values and environmental quality, should also be included in the analysis; such externalities, by definition, are not captured in beneficiary valuation. More experimentation with ways of taking account of such externalities in rate of return analysis of infrastructure is needed.

Finally, to practice a demand orientation in both the evaluation of investments as well as in their operation and regulation requires performance indicators which reflect quality of service and user satisfaction." (Kessides, 1993, pp 35 - 38.)

Cairncross suggested that maximum leverage in investment in low cost domestic sanitation technology might be obtained by targeting households other than the poorest. (Box 7.2)

7.7 Allocating the costs and distributing the benefits of water and sanitation services

As already noted, inadequate water services have a particularly adverse impact on the poor, facilitating the spread of disease, especially in crowded low-income areas. "Thus special efforts will be directed to meeting the water needs of the poor. Moreover, the health benefits of better hygiene and clean water should be emphasised so that the advantages of having an improved water supply can be fully realised. Where public finance is scarce, significant additional resources can often be mobilised within local communities. Efforts should be made to determine the level of services actually wanted by the poor. Research and experience suggest that the poor are willing to pay for reliable service. Indeed, in the face of unreliable service, the poor often pay more for less water. [This is described in Chapter 9] .... Water entities that have a financial stake in serving the poor are more likely to provide them with better, more sustainable services.

"Social fees", whereby the better-off cross-subsidise the poor, as well as budgetary transfers to subsidise connections, can be used. However, caution is required. Assigning non-commercial objectives to a public enterprise may undermine the achievement of its service objectives, possibly initiating a new round of the vicious cycle of unsatisfactory service and low collections." (World Bank

Policy 1993, p15)

Others criticise the "conventional wisdom" of privatisation that is implied in the above, and plead for a continued strong role for government. For example:

"Many forms of infrastructure and service that are important for health, and where costs per household are relatively low, will simply not be provided without government intervention. For instance, private sector enterprises may provide particular services for which they can charge individuals as they use them (for instance water and health care) but they will not provide paved roads and sidewalks and site drains because they cannot charge individuals as they use them.

There are also redistributional implications in the supply of infrastructure and services. Good quality schools and health care can help to address inequalities of opportunity arising from high levels of poverty and low incomes. Improvements in water supply, sanitation and drainage remove large health burdens that are also large economic burdens. ....

Although, again, discussions of redistribution do not accord with current conventional wisdom, all the efforts to provide infrastructure and services to low-income groups with "full cost recovery" in one sense simply legitimise the inequality. They also forget how common it is for middle and upper-income groups to receive publicly funded infrastructure and services (roads, water supply, provision for sanitation and garbage collection, housing finance...) that is subsidised. They forget how low-income households often have the least "free time" to contribute to installing or maintaining new forms of infrastructure or services yet, to cheapen costs, they often receive forms of infrastructure and services that require more of their time and effort. As the paper on Dhaka shows, composting latrines are hardly appropriate if they take up a large part of a very small plot and need to be emptied regularly but with no regular municipal service to do this. [Box 5.1]. Communal water taps greatly increase the time and effort needed by households (usually by women and children) to fetch and carry the water. Unless the taps are very close to a house, the level of water used falls to below that required for maximum health benefits. Very few professionals appreciate the sheer physical effort needed to fetch and carry all the water needed for household tasks, even when a tap is only 20-30 metres from the home. When a decision is made to provide communal taps to a low-income settlement, has this taken into account the extra cost in terms of the time, effort and health burden these imply over water piped into homes? Has it considered the preferences of those who collect the water, and have to manage the cooking, washing, laundry and other household tasks that require water and their readiness to pay more for household connections?" (**Environment and Urbanisation** 1994, pp6&7)

However, the above writers are not totally negative of the "conventional wisdom", as they advocate

".... a changed role for government - one that moves from government as a provider of infrastructure and services to government as an "enabler", working with the community and resident organisations formed by the inhabitants of low-income settlements and with local NGOs, private sector groups ..... Perhaps the most important theme ..... is how much can be done to improve infrastructure and service provision to low-income households at a cost that is affordable to government, with substantial cost recovery, if new approaches are taken. It is not that the papers in this issue describe new models that can be replicated. What they show is new ways in which, within particular social, economic and political contexts, individuals, households, community organisations, NGOs, many different government agencies and international funders combine resources." (**Environment and Urbanisation** 1993, pp6&7)

7.8 Chapter 7 conclusions

The conclusions are, briefly, that -

- economic appraisal of water and sanitation projects is often not done because of an opinion that water is "beyond price"
- another reason why it is often not done is that the institutions that make decisions on investments are more confortable with capital intensive investment on new projects, than on better utilisation of existing capital works, or other forms of investment;
- thus, typically, there is no serious quantification of benefits, and thus appropriate comparisons between alternative projects are not made;
- despite the conceptualisation of "integrated" and "comprehensive" water resource planning, most planning is done incrementally;
- economic analysis based on the benefits being the projected revenues are of little value, because prices are often subsidised for social reasons;
- large publicly financed investments often result in very different financial and economic gains (or costs) for different groups, and are typically the focus of intense political activity;
- there is a case to be made for greater local participation and control, and greater accountability;
- the economic returns on investment in water and sanitation are often under-estimated, because, although the value of improved safety and time savings may be taken into account, the benefits of increased health and increased labour productivity are not;
- economic analyses are often focussed on the costs and benefits in one sector alone, whereas costs and benefits may be thrown onto other sections as well;
- the costs of insufficient water and sanitation are often disproportionately borne by different groups, especially by the very poor ("the geography of inequality"); vulnerability is linked to a lack of means both to avoid an environmental hazard (including insufficient water and

sanitation) and to cope with its impact;

- for the very poor, lack of or a breakdown in water or sanitation can lead to a downward spiral into absolute destitution;
- despite the value of public works programmes (for example, for water and sanitation), they could under certain circumstances displace more productive investments;
- public works programmes can be effective in generating significant amounts of short-term employment and income transfer; this investment can have greatest leverage where the reduced costs and increased income are most direct and apparent to beneficiaries, such as at a very local level;
- however, greater long-term economic benefits could derive if projects were selected and designed to maximise these economic benefits, and not only to maximise employment during construction;
- to ensure that projects meet effective demand, beneficiary communities should contribute to the costs of investment as much as possible, and should take responsibility for financing operation and maintenance;
- efforts should be made to determine the level of services actually wanted by the poor, and what their willingness to pay is;
- inappropriate pricing (such as subsidies) can divert investment from its most efficient use;
- debates on "full cost recovery" for services provided to the poor should not forget how the better-off receive other subsidised services (for example roads) for which it is not possible to implement full cost recovery;
- investment in water and sanitation to serve the commercial and industrial sector may, through expanded production and employment, and reduced prices, bring greater economic benefits than would investment to serve the domestic sector;
- infrastructure investment cannot create economic potential - it can only help to develop this potential where it already exists;
- the planning of supply should take account of all possible alternatives; including measures to increase the efficiency of existing facilities.

7.9 Notes on additional references

- For more on the value of time saved by improved water and sanitation, see -
  - Whittington, Mu and Roche 1990
  - Whittington and Choe 1992.

- For a comprehensive review of the economics of water and sanitation (and solid waste) in one city, see -

- Porter 1995 (on Jakarta)

- For a discussion of the behavioural difference when users undertake self-provisioning options, as distinct from remaining solely as consumers, see -
  - Humplick, Kudat and Madanat, 1993

- For a review of the World Bank's own methods of economic analysis of proposed projects, see
  - Lovei 1992

- For a review of the use of "cost-of-illness" approaches to economic impact studies for water-related projects in developing countries, see -
  - Paul and Mauskopf 1991.

Box 7.1 The impact on health of urban environments

"The case studies of Accra and Jakarta examine a representative cross-section of households in each city, and provide details of a range of chronic environment and health problems.

In Jakarta, there were large disparities between the richest and the poorest households in the incidence of acute respiratory infections. In Accra, diarrhoea problems provide a very clear example of the wealth-environment-health connection. The environmental risk factors found to be associated with a high prevalence of childhood diarrhoea read like a list of poverty indicators: overcrowded toilets (because each is shared by many households), fly infestation, interruptions to water supplies, questionable water storage practices and children practising open defecation in the neighbourhood. Among 102 households with children who face five or more risk factors, 37 had children with diarrhoea in the two weeks prior to the interview. Among the 202 households with less than three risk factors, there were only four cases of diarrhoea.

As with most of the other environmental health problems examined, the burden does not fall indiscriminately, but targets particularly disadvantaged households. Moreover, the risk factors identified reflect the absence of basic amenities whose costs should not be an insurmountable barrier. The problem for low-income groups is not just that they face the greatest risks, but that the hazards affect them more profoundly. More than any other paper, it is the case study of a low-income settlement in Khulna that illustrates the burden that goes with being poor and unhealthy in a Third World city. This paper documents the loss of income and nutritional problems in households where the main income earner is too sick to work. In the case study settlement, it was the poorest households who lost most work days to illness or injury and also most income and much the highest proportion of income. Most such households were heavily in debt. Many of their incapacitated income earners had chronic illness that imply a continuous limitation on the capacity to work. Households with severely incapacitated earners were also much more likely to have severely undernourished children. In addition, among the households with severely undernourished children and incapacitated income earners, most family members were undernourished. The estimated cost of medical treatment was less than the wages lost through illness or injury.

One can only hope that the economical and nutritional consequences of sickness among poorer households in this settlement in Khulna are exceptional. If poorer households in other cities face comparable health and nutritional problems, the health burden associated with urban poverty is greatly underestimated.

One of the few generalizations which appears to have validity in much of the North and the South is that poorer groups suffer disproportionately from the health effects of environmental problems."

(McGranahan, Mitlin and Satterthwaite 1993, pp 3 and 4).

Box 7.2 Leverage in domestic sanitation investment : which target group?

Maximum leverage in investment in low-cost domestic sanitation technology might be obtained by targeting households other than the poorest.

"In practice, ... one is often faced with a dilemma. In most societies, the first to take advantage of new technology, credit, government subsidies, and opportunities to improve their standard of living are the relatively well-off members of the population. They are economically more secure and better able to take initiatives others might perceive as risky; they are better educated and more aware of the benefits offered. Innovations they adopt are likely to acquire an aura of status that makes them attractive to emulate. Should one therefore target the promotion at this group, as well as the poor?

The dilemma is most acute when a subsidy is involved. Is it equitable if a subsidy intended to put sanitation within the reach of the poorest is taken up by those who could afford build their own? Is one to put a ceiling on the income of the households which are allowed to benefit from the program? In many cases, the problem is solved when the wealthiest households aspire to more expensive sanitation systems such as conventional sewerage or septic tanks, but it cannot always be assumed that this will occur. On the other hand, it is not necessarily bad if relatively well-off households adopt the sanitation technology which is being promoted. As long as their participation does not absorb an excessive amount of program resources, it can help to turn a latrine into a status symbol others will wish to acquire.

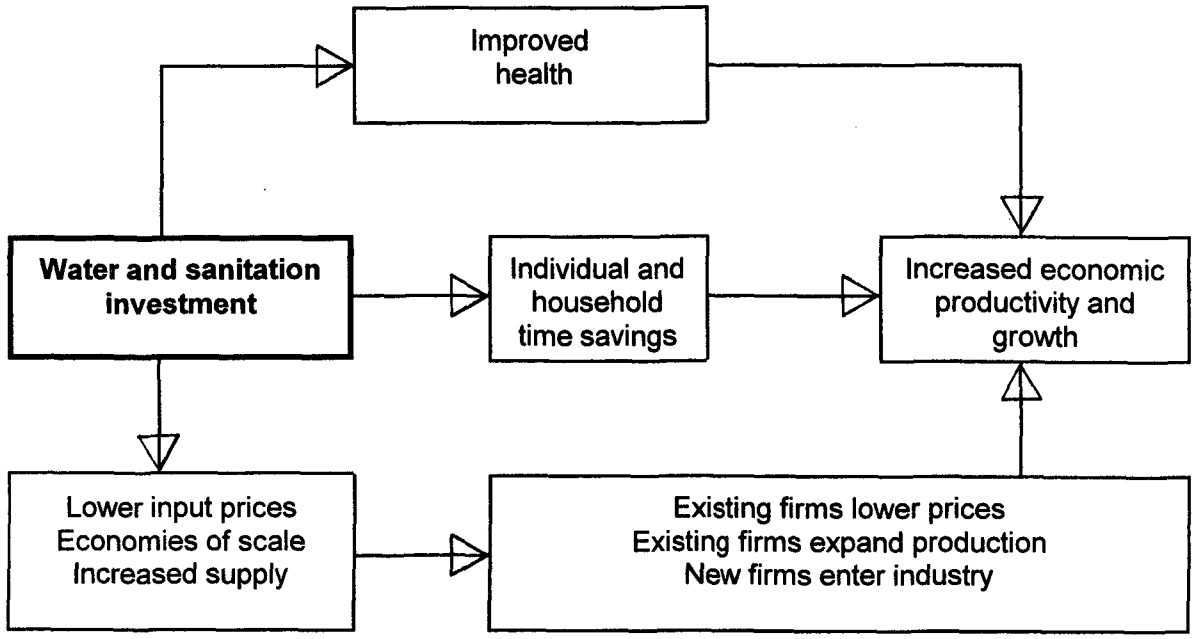
The argument can be taken further. The program may be specifically targeted, initially at least, at those a little above the poorest socioeconomic status. This is not as heartless or as unpre-cedented as it may seem. Most sanitation programs are limited in their coverage to those with more or less permanent housing, and if they include some degree of cost recovery or self-help construction, they are likely to exclude the very poorest households. The promotion of pour-flush latrines in urban India is not aimed at pavement dwellers.

A more striking example is found in the rural sanitation program in Zimbabwe. One of the latrine designs originally developed for rural application was of minimum cost as it used very few materials that were not available locally. However, this type was later dropped from the program because it required a fair amount of maintenance if it was not to deteriorate in a few years. Construction of the more substantial designs required greater expenditure on the part of the owners, but this was not considered a disadvantage. The program was deliberately targeted at households of average or above-average income, as it was believed that this would impart status to latrine ownership so that lower-income households would be encouraged to save for latrines of their own. That in fact occurred, and coverage levels of over 60 percent have been achieved in many villages."

(Cairncross 1992, pp 50 & 51.)

Figure 7.1

Economic benefits from investments in water supply



(Schwartz and Johnson 1992, p5.)

8. EXPERIENCE IN ENVIRONMENTAL AND SOCIAL ISSUES

8.1 Chapter 8 introduction

As noted in the introduction to Chapter 7, Chapter 8 deals with:

- the context of environmental and social issues (Section 8.2)
- perceptions of "the environment" (Section 8.3)
- impacts on biophysical environment (Section 8.4)
- environmental health impacts (Section 8.5)
- social issues, including cultural issues, community involvement, community preference and the role of women (Section 8.6)
- environmental legislation (Section 8.7).

Chapter conclusions are in Section 8.8.

The term "the environment", as used throughout the report, encompasses both "green" and "brown" (see Section 4.2), unless otherwise stated.

8.2 The context of environmental and social issues

The World Bank noted, in its review of urban policy and economic development, that ".... the emerging environmental crisis in towns and cities [is] a problem receiving far less attention than that going to such global environmental issues as global warming or the scarcity of water resources. Urban environmental problems add much to these global problems because of the intensity of energy and resource use and the concentration of wastes and emissions. However, while the impacts of global problems are long-term, the impacts of environmental problems [while long-term] are also short-term. These impacts on the health and productivity of individuals, households, and communities are immediate - from congestion, air and water pollution, inadequate sanitation, erratic waste collection and disposal, and the destruction of marginal lands. .....

The main health risks from environmental degradation are those from pathogens in the environment, indoor air pollution, substandard housing, and industrialisation. Deaths and illnesses from gastroenteric and respiratory diseases are closely linked to substandard housing and infrastructure. Diarrhea and respiratory infections are leading killers of infants in the least developed countries. Acute respiratory infections in children and chronic bronchitis in women are closely linked to inadequate housing and especially smoke exposure. Air pollution and exposure to toxic chemicals also exact a heavy health toll.

Environmental degradation also has long-term effects on resources, threatening not only human health and ecosystems but also the sustainability of development. Groundwater depletion or contamination can be serious, as can the loss of land resources when the development of wetlands, coastal zones, or erosion prone areas is not controlled. Hazardous industrial wastes are another major concern, since it is difficult to monitor discharges and ensure that they are not put into sewers or landfills - and since few developing countries have the facilities needed to treat and dispose of hazardous wastes. And many environmental problems with national and international implications - such as emissions of carbon dioxide, sulphur dioxide, and nitrous oxide - have their origin in urban industry and transport.

Despite these local problems, they are poorly understood in developing countries and require a major research and development effort to identify effective approaches to their solution. To develop sustainable approaches to the management of the urban environment requires:

- Raising global awareness of the urban environmental crisis, in order to develop the political support for action.
- Improving the information base and understanding of the dynamics of environmental deterioration in urban areas.
- Developing city-specific urban environmental strategies that respond to the circumstances of individual cities.
- Identifying programs of curative action for cities to redress the most serious environmental consequences of past public policies and private behaviour.
- Formulating effective national and urban policies and incentives to prevent further environmental deterioration." (World Bank 1991, pp11&12)

McGranahan, Mitlin and Satterthwaite noted that, through economies of scale, ".... cities have so many advantages in terms of lowering the costs of reducing disease and improving environment and health..... [Yet] it is ironic that, in most instances, cities have failed to ..... ensure that all citizens' most pressing needs for health are addressed.

The fact that populations are concentrated in cities greatly reduces the unit costs of providing each building with piped water, sanitation, garbage collection, paved roads, electricity and drains. It reduces unit costs for health services and the provision of schools, pre-school centres and child development centres. Even in most squatter settlements, population densities are not too high to pose problems for the cost-effective provision of such infrastructure and services. Industrial concentration in cities reduces the cost of enforcing regulations on environmental and occupational health and pollution control. It cheapens the cost of many specialised services and waste-handling facilities - including those which reduce waste levels or which recover materials from waste streams for re-use or

recycling. The concentration of households and enterprises in cities makes it easier for the public authorities to collect taxes and charges for public services while, in prosperous cities, there is a larger revenue base, a larger demand and a larger capacity to pay. **Only in the absence of effective governance, including the institutional means to collect revenues and ensure the provision of infrastructure and services and the control of pollution, are health and environmental problems greatly exacerbated.** [Emphasis in the original.]

Analyses of the sectoral priorities of development assistance agencies in their urban programmes show a very low priority to preventative, focused, community based health care and a relatively low priority to other project interventions which can bring major health benefits, such as water supply, sanitation, literacy and poverty reduction..... [It is important] for the health of individuals, households and communities [that they are] able to tackle problems. Empowerment for health comes partly from the knowledge and resources which allow effective action. It comes from a societal recognition that everyone has a right to receive public services and to determine how they are provided, even if the range of such services is limited by the resources and organisational capacity of local government, especially in poorer countries.....

For individuals and households, the health benefits of empowerment go much deeper than just the physical improvements that it encourages them to undertake, since permitting and supporting people to be effective in itself promotes good health. But empowerment becomes of central importance to governments. Where individuals, households and communities are empowered (..... in the sense of giving them more political power to ensure their needs and priorities are addressed, and more control over the use of resources allocated to meeting their needs..... [for example by] ..... permitting women a much greater influence on priorities and investment in water and sanitation will mean higher living standards, improved health and lower costs), they can (and often do) contribute so much to a healthy city, at little or no cost to the public authorities. Where a large proportion of citizens are not empowered, the health burden can rise to the point where it can swamp the resources of even the wealthiest societies." (McGranahan, Mitlin and Satterthwaite 1993, pp4-6)

8.3 Perceptions of "the environment"

There is much evidence of significant difference, in perception of issues relating to "the environment", between different socio-economic strata living in the same city. These differences have significant implications for remedial intervention.

The differences relate to the access that some enjoy, and others do not, to public services, and to the environmental risks associated therewith. On the one hand, those having access to all services will

emphasize the need to improve water quality and air quality. On the other hand, people living in inadequately serviced areas will emphasize the need to improve their access to basic urban services and to increase the quantity and reliability of these.

The latter will place more emphasis on those environmental aspects that are directly linked to their daily lives. "Their perceptions are generally oriented towards the constraints and discomforts that these problems provoke. .... These perceptions point to the fact that they lay less stress on the health impacts of environmental factors, as they do not perceive them as having a direct impact on their family's daily lives..... The research provides the basis for more qualitative questions, to provide a more in-depth understanding on perceptions and practices in the population - their ambiguities and contradictions. In other words, this might lead to more in-depth knowledge on the chain of relations between what the households may or may not identify as being environmental problems, what they detect as the source and cause of the problems, and what directs their attitudes towards possible solutions." (Jacobi 1994, pp107-108) (See also Box 8.1)

Attitudes, it was found, were largely determined by "... lack of awareness of environmental health risks by households, as well as their expectations and frustrations in the face of government action / inaction or omission when environmental related problems develop." For example it was apparent from the research that significant change in attitude could be expected for a redressing of the "... lack of information on certain issues in all strata, city regions and types of housing. The misinformation is related to:

- maintenance of water tanks and containers;
- costs and monthly charges for public services such as solid waste collection and sewerage; and;
- risks to health resulting from environmental factors." (Jacobi 1994, p108)

"It becomes a stimulating task to formulate strategies based on participatory interactions of non-governmental organizations in generating and maintaining socio-political commitment to achieve environmental management objectives - especially those oriented towards the poorest strata of the population. .....The main change to be sought is to motivate joint responsibility between households and public authorities in the management and control of sources of pollution, mainly when they are not at the household level. One cannot disentangle the role of the state and the role of the citizens. This means that both responsibilities have to be stressed. The research on which this paper is based indicates that people are motivated to collaborate with government but government must take on its role in the orientation and management of the conflicts in the continuous search for safeguarding the general interest.

Four relevant actors have to be considered with this process; government, private actors (individuals and collective); entrepreneurs / NGOs, and international donors. All possible kinds of collaboration have to be generated to make concrete effective action to address the continuing environmental degradation." (Jacobi 1994, pp109&110)

8.4 Impacts on biophysical environment

As noted in Section 4.2, while the old agenda with its focus on water and sanitation services still poses immense financial, technical, and institutional challenges, a new agenda that emphasizes environmentally sustainable development has emerged in recent years.

"This concern extends to both the quantity and the quality of surface water and groundwater. The quality of the aquatic environment is a global concern, but the situation in cities in developing countries is especially acute. Even in middle-income countries, sewage is rarely treated. Buenos Aires, for instance, treats only 2 percent of its sewage - a figure that is typical for the middle-income countries of Latin America. As shown [in Figure 8.1], water quality is far worse in developing than in industrial countries.

Furthermore, while environmental quality in industrial countries improved over the 1980s, it did not improve in middle-income countries, and it declined sharply in low-income countries.

The costs of this degradation can be seen in many ways. Most rivers in and around cities and towns in developing countries are little more than open, stinking sewers that not only degrade the aesthetic life of the city but also constitute a reservoir for cholera and other water-related diseases. And as the "urban shadow" of pollution spreads concentrically around a city, expensive adaptations are required so that water supplies can remain safe. To take just one case, Shanghai had to move its water supply intake 40 kilometres upstream at a cost of US$300 million because of the degradation of river quality around the city." (Serageldin 1994, pp4-6)

Impacts on the biophysical environment that then directly relate to health of urban dwellers are those of natural resource degradation caused by pollutants. "One example is through land or water used by urban households for urban horticulture being polluted by urban wastes. A second, more indirect route is damage to local food production outside the city from air or water pollution. ..... [Both then impact] on the health of poorer households through decreased food availability or higher prices." (Satterthwaite 1993, pp100&101)

As a result, the World Bank has adopted the following policies:

- "**Urban pollution:** .....Public disclosure of information relating to industrial and municipal effluent or waste discharges helps communities to pursue and implement policies that protect public health and environmental sustainability. .....the Bank will encourage national implementation as part of capacity building.....

- **Ecosystems:** The Bank will offer its assistance to governments in developing strategies and cost-effective mechanisms for the ecologically sustainable management, protection, and restoration of recharge areas and water-dependent ecosystems, such as wetlands, riverine floodplain areas, estuaries, and coastal zones. Such systems serve as biophysical filters, safeguard biological diversity, and conserve water resources. Restoration of these ecosystems is an integral part of improving the management of water resources.

- **Groundwater protection:** ..... The Bank will support the establishment of government programs and policies to restore and protect the quality of groundwater and to preserve groundwater recharge areas." (World Bank 1993b, pp74&75)

8.5 Environmental health impacts

"Environmental health impacts" are defined, for present purposes, as those impacts related to the spread of disease and contamination through water supply and sanitation systems.

Biological pathogens in the human environment - in water, food, air or soil - represent the single most serious environmental problem in terms of their impact on human health. These pathogens can be classified according to the medium through which human infection takes place: foodborne, airborne or water related. For some, infection may occur through contaminated food or water.

Box 8.2 lists the main water-related infections, and gives estimates of morbidity, mortality and population at risk (where these are available). "These are global estimates covering rural and urban areas; there are no figures which cover only urban areas. Waterborne diseases are the single largest category of communicable diseases worldwide and account for more than 4 million infant and child deaths per year. In many Third World cities or city districts, waterborne diseases are among the major cause of infant and child death and a major cause of adult death. In contrast, very few fatal cases of waterborne diseases are now recorded in Europe or North America.

Diarrhoeal diseases account for most water related infant and child deaths in urban areas, and a high proportion of illnesses. Risk factors include overcrowding, poor sanitation, contaminated water and

inadequate food hygiene. Many studies of poor urban districts have shown diarrhoeal diseases to be a major cause of morbidity and mortality. Where water supplies and provision for sanitation are inadequate for high proportions of the entire population, they can remain one of the most serious health problems within city-wide averages.

Among the various water-related diseases listed [in Box 8.2] ... , filariasis and intestinal worms (especially ascariasis / roundworm) stand out for the millions of urban people who are debilitated by them; only a small proportion of those infected with these diseases will die of them but they cause severe pain to hundreds of millions of people. Various case studies in low-income settlements have shown that a high proportion of the population have large intestinal worms burdens.

Many disease vectors live, breed or feed within or around houses and settlements in urban areas. The diseases they cause or carry include some of the major causes of ill-health and premature death in many cities - especially malaria (*Anopheles* mosquitos) and diarrhoeal diseases (cockroaches, blowflies, and houseflies). There are severe problems with malaria in urban areas in large parts of Africa, Asia and Latin America. In many cities or poor peripheral city districts, malaria is one of the main causes of illness and death. There are also many other diseases caused by or carried by insects, spiders or mites. .....Many of these vectors thrive when there is poor drainage and inadequate provision for garbage collection, sanitation and piped water supply. .... Leptospirosis outbreaks have been associated with flooding in San Paulo and Rio de Janeiro - the disease passing to humans through water contaminated with the urine of infected rats or certain domestic animals." (Satterthwaite 1993 pp89-91)

"Infants and young children are at greater risk of dying from many environment related diseases that older children or adults - for instance diarrhoeal diseases, malaria, pneumonia or measles. Infections and parasites arising from contaminated food or water can contribute much to undernutrition which, in turn, retards a child's growth and lowers their immunity. Infants are also more at risk than adults from various chemical pollutants such as lead (in food, water and air) and high nitrate concentrations in water. The transfer of infants and young children from exclusive reliance on breast milk to formula milk and semi-solid and solid foods is often particularly hazardous for those living in housing which lacks safe water and the facilities needed for hygienic food preparation and storage." (Satterthwaite 1993, p105)

Not wholly in agreement with the above is the observation that: "Recent diagnostic advances point to interpersonal contacts as being at least as, if not more, important, in the transmission of diseases than the more traditional routes such as contaminated water and food. Improved diagnostic techniques now indicate a multiplicity of causes heretofore unsuspected, and consequently a change

in emphasis of interventions. These confirm that water quality and quantity are not the single most important elements in direct transmission of gastroenteric infections --- primarily the killer diarrheas. They also imply that since interpersonal contacts and contaminated living environment --- dirty floors, play areas, markets --- are important mechanisms for disease transmission, a greater effort than in the past will have to be made to improve housing, excreta disposal and personal hygiene. The implication that it is necessary to change behavior, furthermore, points to a greater role for education, especially as it pertains to diseases with multiple routes of transmission, and makes the need for simultaneous interventions more critical. The problem, of course, is compounded when applied to the main audience, the poor and low-income groups. Behavioral change is complicated and takes time --- normally more time than the average life of a project." (Listorti 1990, p viii.)

There are environmental hazards to which women are exposed more than men, "..... as a result of differentiation by gender as a result of women taking sole (or primary) responsibility for child-rearing, household management and subsistence production. The fact that women take most responsibility for child care means that they also have to cope with most of the illnesses and injuries from which infants and children suffer and to which infants and children suffer and to which environmental hazards contribute greatly. Caring for the sick and laundering and cleaning soiled clothes are particularly hazardous tasks when water supplies and sanitation and washing facilities are inadequate. The people within a household who are responsible for water collection and its use for laundry, cooking and domestic hygiene suffer most if supplies are contaminated and difficult to obtain - and these people are generally women." (Satterthwaite 1993, p107)

There are many studies of links in the chain of water- and sanitation-related illness. For one such, on storing drinking water in the home, see Box 8.3.

8.6 Social issues, including cultural issues, community involvement, community preference, and the role of women

The economic advantages to when productivity, through water and wastewater/sanitation provision to the comercial and industrial sector as well as to the domestic sector, can also be shown.

Cultural issues that affect water and sanitation practices are many and varied. They may include -

- religious beliefs may dictate that women and men cannot use the same latrine.
- that the selection of community spokepersons on water and sanitation issues may be wholly unrepresentative of those with most to benefit or to lose from change.

The topics of community and individual involvement and preference in a general sense are covered elsewhere in this report; particularly in Section 6.1.3.

Listorti stressed the need to involve two "target groups", viz "poverty groups" and "women".

"Project beneficiaries ... of low socio-economic status usually need to better understand the interrelationships among health, water, sanitation, and housing in order to improve their personal hygiene practices and properly maintain the services. Thus, the feasibility of introducing health education and hygiene training (existing or new programs) should be at least considered for all such projects. Depending on the beneficiaries' health status, other actions such as immunization or nutrition improvements, may be desirable.

..... No matter what combination of services make up a typical project ....., women figure predominantly as key participants and beneficiaries. Women support families, manage households, fetch water, and care for children when healthy or sick. Their specific needs will therefore require consideration as a high-risk group and as a primary audience. Sustained health improvement stemming from water, sewerage or urban development sector projects hinges on education and behavioral change, factors which fundamentally involve women. Indeed, their role in ensuring the success of a project or component should not be underestimated; and their inputs and opinions actively solicited." (Listorti 1990, p9.) (See Box 8.4 and Box 8.5)

8.7 Environmental legislation

The World Bank noted that many countries do not have standards to control water pollution adequately or the capacity to enforce existing legislation. Due to industrial pollution more than to pollution from domestic sanitation, ".... although in recent years there has been improvement in the levels of water pollution in the industrial world, problems of water quality remain. In the United States, almost 50 percent of the waterways are still impaired by pollution, as are many of the major rivers and near-shore Great Britain, Japan, and Scandinavia." (World Bank 1993b p32)

The sheer hopelessness of enforcing any meaningful environmental legislation in developing countries, in view of the huge numbers of households without adequate sanitation (and indeed is environmental legislation a priority as long as there are gross infrastructural deficiencies?), is sufficiently covered in this Chapter 8.

8.8 Chapter 8 conclusions

The conclusions are, briefly, that -

- the main health risks from urban environmental degradation are those from pathogens in the environment, indoor air pollution, substandard housing, and industrialisation; illnesses and deaths, especially from gastroenteric and respiratory diseases, are closely linked to these;
- environmental degradation also has long-term effects on natural resources; eg through groundwater contamination;
- through concentration and economies of scale, the unit costs of providing engineering infrastructure, health services and the like, are reduced in cities compared to providing them in dispersed areas; however, the absence of effective governance can be instrumental in environmental problems being exacerbated in cities;
- different groups in the same city can have different perceptions of environmental issues, and this directs their attitudes towards proposed investment; for example, those already having access to services will wish for improved quality, while those without access will wish for access, and for increased quantity and reliability of services;
- the poor are more at risk than the well-off;
- while environmental quality in industrial countries improved over the 1980s, it declined sharply in low-income countries; this impacts on city dwellers in terms of more expensive water sources, higher prices for food, etc;
- infants and young children are at greater risk from many environment-related diseases than are adults;
- women are often more exposed than men to environmental risks but are less often consulted with respect to investment proposals;
- furthermore, sustained health improvement stemming from water and sanitation depends on women in their role in the family and especially as primarily responsible for the health and education of the children;
- cultural issues can affect water and sanitation practices;
- the poor are more at risk than the well-off;
- many countries, especially developing countries, do not have standards to control water pollution nor the capacity to enforce existing legislation.

8.9 Notes on additional references

- Atkinson in 1993 reviewed the available literature on urban health. Of particular interest are the sections on "environment and health" and "the urban policy agenda in the nineties and urban health". (Atkinson 1993, pp146-152)

"Two [of the publications] in particular are well appreciated by those working in urban health: *The Poor Die Young; Housing and Health in Third World Cities* edited by Cairncross, Hardoy and Satterthwaite (1990) and *Environmental Problems in Third World Cities* by Hardoy, Mitlin and Satterthwaite (1992). The former does address environmental health in urban areas and collects together examples and possible low-cost actions for specific problems such as water, sanitation, garbage disposal, emergency services and so forth. The more recent book, prepared for the United Nations Earth Summit in Rio in 1992, must be the most comprehensive collection of evidence and information on the range of urban environmental problems, from the age-old challenge of clean water through to more recent threats from industrial pollution. Although the primary focus of the book is to document threats to environmental degradation, the message is clear that this cannot be separated from human welfare, [and] the two are often closely related....." (Atkinson 1993, p148)

- Bradley et al in 1992, in ".....assessing the relative health impacts of physical environmental problems in urban areas of developing countries in order better to guide [the World Bank's] urban policy and investment decisions, ... reviewed [over 100 studies] on health in the urban areas of developing countries....

The group most commonly studied is children. An abundance of studies demonstrate a high prevalence of diarrhoea and helminth (parasitic intestinal worm) infections in children of slums, shanty towns and squatter settlements, yet there is a dearth of studies on respiratory infections. The elderly and teenagers are also vulnerable groups, but are neglected in research.....

The studies analyzing morbidity are more numerous than those tackling causes of mortality in urban areas, but they do not show a comprehensive or uniform pattern of linkages between urban environment and health. Analysis of infant morbidity and its relation to water accessibility, water quality, and sanitation shows some of the strongest associations of environmental variables and disease outcomes. Many studies point to the complex synergism of environmental and social risk factors for disease, and there is much evidence that health outcomes in the urban environment derive ultimately from the socioeconomic more than the physical environment. Poverty remains the most significant predictor of urban morbidity and mortality.

Notwithstanding the obvious gaps in the information available and the uniqueness of each city's health status, the review does suggest a stylized urban health profile that provides a useful point of departure for analysing health conditions in a specific city:

- In contrast to higher income urban dwellers and some rural populations, the urban poor have a lower life expectancy at birth and a higher infant mortality rate.

- The relationship of infant and child mortality to the quality of and access to water and sanitation is significant - children from households using public standposts and cesspools are several times more likely to die of diarrhea than those with in-house piped water and sewerage.

- Urban poor households sometimes have worse nutritional status than rural households, contributing to ill-health related to nutrition.

- Female children in slums are further disadvantaged compared with males in terms of differential nutrition, health care, and mortality.

- When a child from a slum is old enough to move independently about the city, he or she may become increasingly exposed to death associated with violent features of modern urban environments, for example, motor vehicle accidents (5-14 years) and homicides (15-19 years).

- In some cities, for youths and young adults, mortality differentials may be due to communicable disease and violence in males, and obstetric causes for females.

- From 15 years onward, trauma and chronic diseases play a substantial role in mortality and morbidity; one particular problem may be the occupational exposure associated with informal, small scale and cottage industry, and exposure in the home.

These hypotheses are open to test: the main challenge is to collect better mortality data, especially regarding the likely causes of death, from cities in the developing world". (Bradley et al; 1992, pp vii to ix.)

- Listorti included ".... a compendium of the 26 most prevalent diseases related to housing, water supply and sanitation. In each case, diseases are broken into three sections: a description of symptoms and effects, their means of transmission, and suggestions for practical interventions. The presentation stresses preventive rather than curative measures..... It may be particularly useful to specialists working in health- related activities who lack scientific or medical training." (Listorti, 1990, p xii.)

- Listorti also "... presents a simplified methodology to gather health data, evaluate the importance of health problems and, especially, assist in preparing a response feasible within an urban, water or sanitation project. Five tables help prioritize diseases according to the practicality of remedial measures which lead to a short list of potential projects. The process essentially requires extrapolation of information on the ten leading causes of morbidity and mortality, followed by suitable interventions in the water, sanitation, and housing sectors.

  With its stress on realistic achievement, the paper focuses on feasible aspects, small components, demonstration projects, and follow-up arrangements by a collaborating institution to combat those health problems not easily integrated as a component into projects. In general, the more complicated the administration and the higher the requirement for education and follow-up, the greater should be the emphasis to seek complementary actions outside the project. Depending on the health assessment of the project area, interventions may be short or long term with appropriate follow-up requirements." (Listorti 1990, p x.)

- For more evidence of the link between water and sanitation infrastructure, or water and sanitation and hygiene education, on the one hand, with health indicators on the other hand, see -
  - Esrey, Potash, et al, 1990
  - Hogrewe, Joyce and Perez, 1993; Chapter 3 (pp 19-25)
  - Chapter 1 "Water and Sanitation" and Chapter 2 "Health aspects" of Kerr 1990.

- For a discussion of the link between wastewater as used in irrigation, and health indicators; and also of options for reducing the risks of wastewater use in irrigation, see -
  - Shuval, Adin, et al, 1986.

- For more on social and cultural factors influencing households' responses to water supply and sanitation technologies, see -
  - Elmendorf and Buckles 1980
  - Perrett 1983 (on "social feasibility analysis".)

- For more on the role of women, see -
  - Elmendorf and Isely, in Kerr 1990
  - Wakeman 1990
  - Melchior-Tellier 1991

- For a comprehensive review of one project that incorporated water and sanitation technological improvements and hygiene education, see -
  - Aziz, Hoque, et al, 1990.

Box 8.1 Households and environment in Sao Paulo

A research project in Sao Paulo, Brazil, provided evidence of:

(i) The different environmental problems, and perceptions thereof, according to socio-economic class.
(ii) The interrelated nature of the causative factors of sickness
(iii) Households living in areas where their health is at risk because of, for example, poor water and sanitation, may not have improving this as their main priority. This is notwithstanding the perceptions of the interviewers, who are invariably from the more educated class, as to the significance of the environmental problems.

Thus (the paragraph numbers correspond):

(i) "The entire population is served by the water supply network in the districts with the highest income stratum. In contrast, in the poorest suburban districts, water supply does not reach 60 percent of the population, whereas in the most established districts, it reaches about 90 percent.

....As with the water supply network, there are differentials in terms of the proportion of households connected, but the scale of the differentials is even more striking. The entire population in the most central districts have connections. In suburban districts, the service in only partial and, in some cases, does not even cover 15 percent of the population." (Jacobi 1994, p92)

"....This shows how the nature of unequal urbanization is reinforced by the existence of particular environmental problems. The dynamics of territorial homogeneity relative to environmental threats reinforces the fact that households which are affected by living on low and flat land alongside water courses are also affected by floods. The most privileged areas of the city are not affected, while the most needy strata reflect the convergence of several urban problems, thus confirming the existence of precarious socio-environmental conditions.

...the population in the areas with the best quality infrastructure (inhabited by the highest income strata) give much more importance to air and noise pollution as a problem than do the lowest-income populations. The lowest-income groups are more concerned about immediate issues and structural shortages in living conditions, so pollution problems are of secondary importance. The lack of public health services, as well as the problems more closely linked to the absence of infrastructure and urban services, received a higher proportion of responses in lower income strata." (Jacobi 1994, pp93 and 94)

"Among the households, 37 percent noted that water shortage and irregular water supply are a major problem. The lowest income strata emphasize the problems related to water storage and its irregular provision, and explicity mention the impacts that these problems have on their daily lives. They also have much more limited facilities for water shortage. There is a clear distinction between the priority given to quantitative factors in water supply by the strata living in less established areas and that given to qualitative factors by those living in more established quarters of the city." (Jacobi 1994, p96)

continued

(ii) "Most of the cases of illness [diarrhoea] were in precarious dwellings and in low-income areas, mainly in *favelas* and peripheral precarious housing. When the interviewees were asked about the factors that caused illness, the answers were: domestic food (19.5 percent), food consumed outside the house (11.9 percent), in-house water (14.3 percent), water consumed outside the house (4.9 percent). Thus the perception of diarrhoea-causing factors involves much more the household setting rather than external household settings...

Another variable that is relevant to the context in which diarrhoea occurs is the respondent's level of education. More than 90 percent of the incidences of diarrhoea occurred in households where the female respondent had, at the most , primary school education, indicating a strong relationship between income level, level of education and the occurrence of diarrhoea in young children." (Jacobi 1994, p102)

(iii) "The respondents' perception of the main problem in the neighbourhood, [even] in those households where cases of diarrhoea in children were recorded, was not related to health and sanitation problems but mainly to the precarious conditions of mass transportation, accounting for 30.0 percent of responses. Daily problems that directly affect the occurrence of diarrhoea in children were mentioned only in third place with the lack of a sewerage system in sixth place. It is understandable that poor transport was seen as the most pressing problem because of its importance for people going to and from sources of work and thus closely connecting it to households' living conditions." (Jacobi 1994, p102)

Box 8.2 Examples of water-related infections, with estimates of morbidity, mortality and population at risk

DISEASE (Common name)	(Name)	MORBIDITY	MORTALITY (No of deaths/year)	POPULATION AT RISK
1. WATERBORNE (and water washed; * also foodborne)				
Cholera	Cholera*	More than 300,000	More than 3000	
Diarrhoeal diseases	this group includes salmonellosis,* shigellosis,* *Campylobacter,** *E. coli*, rota-virus, amoebiasis* and giardiasis*	700 million or more infected each year with over 1,500 million episodes in children under five	More than four million	More than 2,000 million
Enteric fevers	Paratyphoid Typhoid	500,000 cases; 1 million infections	25,000	
Infective jaundice	Hepatitis A*			
Pinworm	Enterobiasis			
Polio	Poliomyelitis	204,000 (1990)	25,000	
Roundworm	Ascariasis	800-1,000 million cases; 1 million cases of disease	20,000	
Leptospirosis				
Whipworm	Trichuriasis			
2. WATER WASHED				
(a) Skin and eye infections				
Scabies	Scabies			
School sores	Impetigo			
Trachoma	Trachoma	6-9 million people blind		500 million
Leishmaniasis	Leishmaniasis	12 million infected; 400,000 new infections/yr		350 million
(b) Other				
Relapsing fever	Relapsing fever			
Typhus	Rickettsial diseases			
3. WATER BASED				
(a) Penetrating skin				
Bilharzia	Schistosomiasis	200 million	Over 200,000	500-600 million
(b) Ingested				
Guinea worm	Dracunculiasis	Over 10 million		100 million+
4. WATER RELATED INSECT VECTOR				
(a) Biting near water				
Sleeping sickness	African Trypanosomiasis	At least 20,000 new cases		50 million
(b) Breeding in water				
Filaria	Filariasis (lymphatic)	90 million		900 million
Malaria	Malaria	267 million (107 million clinical cases)	1-2 million (three quarters children under 5)	2,100 million
River blindness	Onchocerciasis	18 million (over 300,000 blind)	20-50,000	85-90 million
Yellow fever	Yellow fever	10-25,000		
Breakbone fever	Dengue fever	30-60 million infected every year		

Source: Adapted from WHO (1992) *Our Planet, Our Health*, Report on the World Commission on Health and Environment, Geneva. Derived from Cairncross, Sandy and Richard G Feachem (1983) *Environmental Health Engineering in the Tropics - An Introductory Text*, John Wiley and Sons, Chichester; and White GF, Bradley DJ and White, AU (1972) *Drawers of Water: Domestic Water Use in East Africa*, University of Chicago Press, Chicago. Figures for morbidity, mortality and population at risk from WHO (1990) *Global Estimates for Health Situation Assessment and Projections 1990*, Geneva.

(Satterthwaite 1993, p 90)

Box 8.3 Comparison of the effects of water source and in-house water contamination.

Storing drinking water in the home is common in the developing world. Several studies have documented increased concentrations of faecal-coliforms during household storage. This has led to the belief that in-house water contamination is an important transmission route for entire pathogens and, moreover, that improving water source quality is not warranted until that quality can be maintained in the home.

The authors contended that in-house water contamination does not pose a serious risk of diarrhea because family members would likely develop some level of immunity to pathogens commonly encountered in the household environment. Even when there is no such immunity, transmission of these pathogens via stored water may be inefficient relative to other household transmission routes, such as person-to-person contact or food contamination. A contaminated water source poses much more of a risk since it may introduce new pathogens into the household.

The effects of water source and in-house contamination on diarrheal disease were estimated for 2 355 Filipino infants. The results confirmed the authors' hypothesis: contaminated sources pose a serious risk of diarrhea while contamination of drinking water in the home does not. Water boiling is shown to eliminate the risk of diarrhea due to water source contamination. The results imply that improvements in water quality are more important than improving water storage practices.

(Briscoe and Van Derslice 1993).

Box 8.4 Women, water and sanitation

a) **Jordan and Wagner**

"In developing strategies, two assumptions which negatively affect women often been made: 1) that a household consists of a nuclear family (i.e. a husband, wife and several children); and 2) that within the family there is a clear sexual division of labour, with the man as the primary earner and the woman as a household wife and homemaker responsible for the reproductive and domestic work. The first assumption is increasingly a fallacy, and the second fails to recognise women's other roles as producers / income earners and as community participants....

Studies on time allocation show that women spend far more hours cooking, cleaning, washing clothes, gathering wood and hauling water than men do.... As one observer commented: "...Because it is [a] women's task, the provision of water is undervalued. Thus, technology to alleviate this task is lacking and insufficient efforts are made to provide communities with safe and convenient sources of water."

Perhaps more significantly as fas as long-term consequences are concerned, the time consumed by women in household and family work cuts deeply into the time available for their role in the economic arena. Considering the increasing number of families who depend on the earnings of women, inadequate water supply and sanitation systems are an added burden."

(Jordan and Wagner 1993, pp 135 - 138)

b) **Rogers**

"Water experts need no reminder that they are dealing with a basic necessity of life, in fact the most important of them all. But they manage to ignore the fact that women are responsible for fetching water, for rationing it out, and for basic decisions about where it should be obtained.

Contaminated water supplies for drinking, which are such an immense health problem, may be the only choice open to women whose own health and strength is severely over-taxed; a great deal of energy and time must be spent on fetching water and they may well not have either to spare for seeking out cleaner sources. Large amounts of water have to be brought in for drinking, especially in hot climates, with extra amounts for cooking and, with luck, a little left over for washing.

Poor women, in both rural and urban areas, have to use great ingenuity in their everyday lives, in the struggle to feed increasing numbers of dependents. Conditions have changed very fast for them. The rapid growth of the cash economy largely excludes them, yet imposes demands for cash for vital services, and the younger men feel free to travel in search of paid jobs and leave the women of the subsistence household with a double shift - their own *and* the men's work.

Many western men, with their double standards of work - that is "real work" being paid and "not work" being unpaid - fail to recognize the crippling work burden borne by Third World women. Yet if there is one bold generalization that it is safe to make, it is that women will respond positively to any innovation which reduces their work-load and/or increases the cash income. It has been observed that women are in fact more sensitive to these kinds of direct incentives to innovation that are men.

continued

Water projects which provide more accessible and more abundant supplies of water, in places that women find convenient and socially desirable, offer perhaps the most direct help in this regard. Not only is the extremely heavy work of water-carrying reduced, but during a dry season extra supplies of water can produce a good crop of marketable vegetables.

There is also, of course, the health benefit where contaminated water is replaced by clean water. This is another area where women are particularly sensitive. Health problems arising from water contamination particularly affect the children of which women have charge and they contribute substantially to infant and child mortality".

(Rogers, in Kerr 1989, pp 18 - 20.)

Box 8.5 PROWWESS

Part of the UNDP is the PROWWESS Programme.

""PROWWESS stand for "Promotion of the Role of Women in Water and Environmental Sanitation Services". It focuses on women, in the context of their communities, because they are the main collectors/users of water and guardians of household hygiene and family health. In the past, even field projects with community participation focus have often neglected to involve women in decision-making, for lack of knowledge about their role or difficulties in reaching them.

The PROWWESS program is demonstrating ways of involving women in wider community planning, operating, maintenance and evaluation of drinking water and waste disposal schemes. Its experience so far in about 700 communities in Africa, the Arab States, Asia and Latin America shows that:

> early and wide participation by women and their communities pays off in better maintenance, higher cost recoveries, improved hygienic practices and other socio-economic gains for the community...

PROWWESS/UNDP is developing, documenting and disseminating information on the participatory methods it promotes and on the outcome of their use. This can help to enrich policies and programmes, both nationally and internationally.

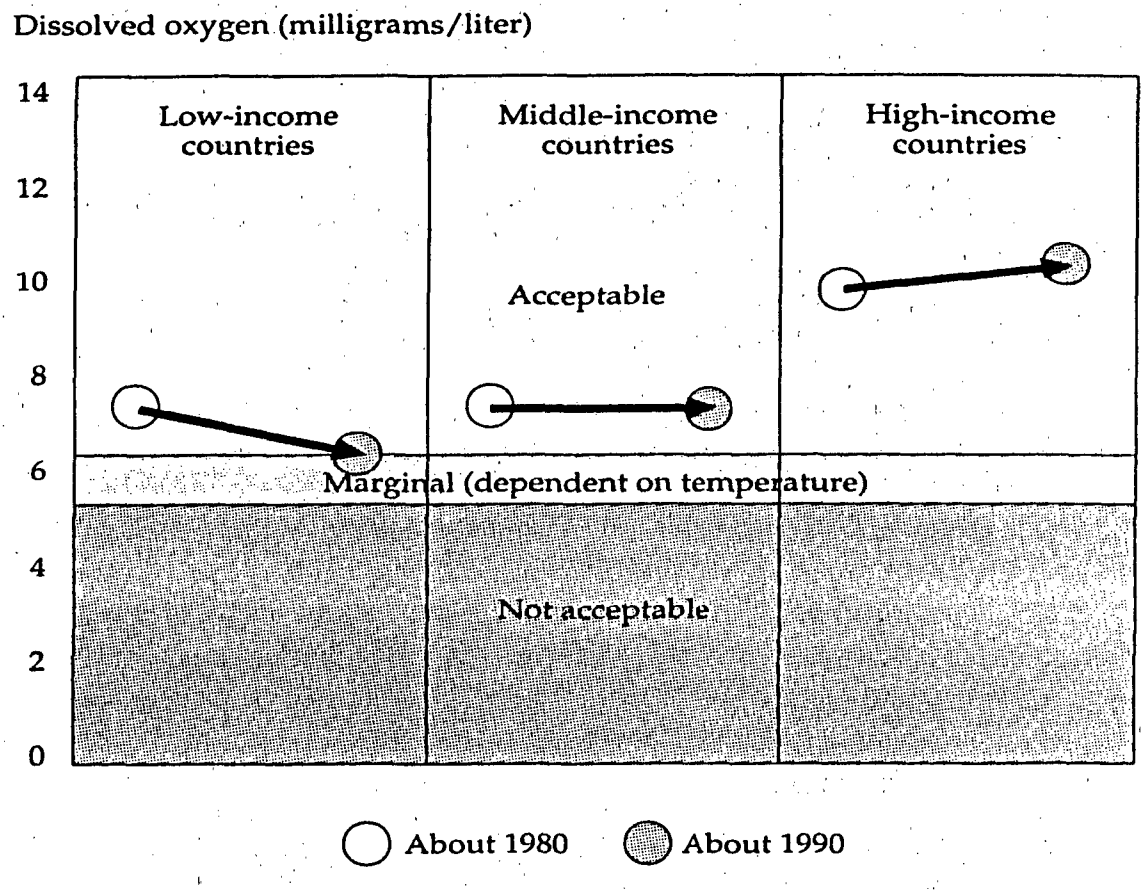
Part of this effort is the PROWWESS/UNDP technical series called "Involving Women in Water and Sanitation: LESSONS - STRATEGIES - TOOLS". It includes:

- case studies, project reports and country profiles giving **lessons from specific experience;**
- guidelines, for project analysis, development and evaluation, and other **strategies of action**; and
- data collection and research instruments, training methodologies, materials production and other **tools for field work.**"

(Narayan - Parker 1989.)

Figure 8.1

Dissolved oxygen levels in rivers in developing and industrial countries



(Serageldin 1994, p5)

9. EXPERIENCE IN COST, PRICE AND AFFORDABILITY ISSUES

9.1 Chapter 9 introduction

In this chapter, the following are discussed -

- the current context of cost and affordability (Section 9.2)
- the relationship between cost, price and affordability: the topics of subsidies and financial sustainability are introduced (Section 9.3)
- costs (Section 9.4)
- price (Section 9.5)
- affordability: also means to increase affordability (Section 9.6)
- willingness to pay (Section 9.7)
- spending on water and sanitation (Section 9.8)
- sustainability, including subsidies and the collection of revenue (Section 9.9).

Section 9.10 draws conclusions.

9.2 Current context of cost and affordability

The poor, in the developing world's urban areas, invariably have lower levels of access and poorer quality of water.

Inadequate municipal supply to the poor is usually substituted by informal sector supply. The poor obtain water through vendors or by installing a handpump paid for by a group of households or through buying from nearby well-to-do households.

"In surveys carried out in 12 cities in the South, it was consistently found that the price of water charged by vendors was a multiple of the price charged by the public water agency, with price ratios varying from 4:1 to as high as 100:1. Therefore, as informal sector supply is the predominant means of access to water for the poor, their unit cost of water is virtually always much higher than that of the non-poor. Yet, these high informal supply prices are prices which the low-income market can bear because of the relatively small quantities consumed." (Wegelin and Borgman 1995, pp139 - 140) (See also Box 9.1)

As with water supply, there are disparities in access to sanitation for different income groups. However, the disparity between the poor and the better-off is significantly higher than in the case of water. Limitations in access to sanitation services are largely due to the financial and institutional

inability of formal service providers to extend their conventional systems into low-income areas. Unlike for water, once the system is designed and in operation, individual "consumption" levels can only vary between being served or not being served by the system. Given that, the price varies more with access to the system than with household income as such.

9.3 The relationship between cost, price and affordability

While "price" is a complementary part of "cost", subsidy is a complementary part of "affordability". The interrelationships between these four aspects can be stated as follows:

(1) A very substantial proportion of the world's urban population cannot afford the "cost" of basic services.

(2) It is generally accepted that all households should have access to adequate water supply and sanitation at a price that they can afford.

(3) The full cost of these services must be carried somehow. Any difference between cost and price has to be made up by some form of "subsidy". If subsidies are too large, they become "unsustainable".

On the question of financial sustainability: Affordability must be considered on a household level, but not only on that level. In other words, one cannot simply consider the ability of an individual household to pay the full costs of the services that it consumes. There must be some consideration of the ability of the country *as a whole* to ensure that the cost of providing adequate water supply and sanitation to all its citizens is covered, taking cognisance of other competing demands for funds.

The World Bank illustrated the influence of social objectives on price. (World Bank 1993b, pp26-27 and 81-82) As follows:

Water and sanitation, especially for domestic use, ".....caters to social objectives that have a wide political acceptance and are thus considered merit goods, that is, their consumption has a benefit to society beyond that which accrues to the individuals consuming them. The access to a certain minimum level of water for human consumption is generally perceived to be such a good, hence subsidies to enhance access to water supplies are common." Merit goods generally have extremely low price elasticities of demand at low (basic) levels of use (for example, the domestic consumption of water). Because services such as drinking water and domestic sanitation are merit goods, they receive political attention, and entities providing these services can be subjected to political

intervention, designed to compel them to reduce their prices or even to provide their service free. Furthermore, since water used in other activities (such as irrigation) could potentially be used for human consumption, entities dealing with such services could also be affected by government interventions. All of these influences, designed to achieve social objectives, can, depending on the circumstances, increase the subsidy burden and reduce the viability of the service. Maybe it will be reduced to the point at which sustainability is threatened - there are precedents for this.

9.4 Costs

Real costs of "old agenda" water supply and sanitation services are changing for several reasons. First are demographic and economic factors. As the population of developing countries becomes more urbanised, per capita costs rise. This is partly because a number of low-cost, on-site urban sanitation technologies (see Table 9.1) become infeasible in dense urban settlements and partly because urban people - as demonstrated in the Orangi (Box 5.3) and São Paulo (Box 6.5) cases - aspire to having a high level of service.

Second are resource factors. "Today twenty-two countries have renewable water resources of less than 1 000 cubic metres per capita - a level commonly taken to indicate severe water scarcity - and an additional eighteen countries have less than 2 000 cubic metres per capita." (Serageldin 1994, p8) Elsewhere, water scarcity is less of a problem at the national level but is nevertheless severe in certain regions, at certain times of the year, and during periods of drought. The effects of these "natural" factors are seriously exacerbated by the widespread mismanagement of water resources, with scarcity induced by the provision of large quantities of water at minimal or no cost for low-value agricultural uses, and by inefficient urban reticulation systems with widespread leakage.

Even with measures to contain the growth in demand and to improve the efficiency of existing systems, new water supplies will be needed for many urban areas. However, the lowest cost and most reliable sources of water have already been developed in many countries. The new sources of supply currently being considered have higher financial and environmental costs than those developed earlier. The costs of municipal water supply and irrigation will increase even further when adequate drainage and sanitation facilities are included as essential parts of these investments. For many cities, "..... the cost of a cubic metre of water provided by "the next project" can be two to three times the cost of current supplies [Box 9.2], even before environmental costs are factored in." (World Bank 1993b, p37)

TABLE 9.1 TYPICAL INVESTMENT COSTS FOR DIFFERENT LEVELS OF SERVICE

	Rural	Urban	
	Low	*Intermediate*	*High*
Water supply	10[a]	100[b]	200[c]
Sanitation	104[d]	255[d]	3 506[e]

1992 prices : US Dollars

a. Handpump or standpump.
b. Public standpipe.
c. Piped water, house connection.
d. Pour-flush or ventilated improved pit latrines.
e. Piped sewerage with treatment.

(Serageldin 1994, p10.)

Widespread inefficiency in supplying water and sanitation is a major factor in the high cost of water sector services. A recent World Bank study, "....which examined more than 120 urban water projects initiated between 1967 and 1989, concludes that despite efforts at capacity building for the public institutions concerned, only in four countries - Botswana, the Republic of Korea, Singapore, and Tunisia - have public water and sewerage utilities reached acceptable levels of performance.

A few examples illustrate how serious the situation is:

- In Caracas and Mexico City an estimated 30 percent of connections are not registered.
- Unaccounted-for water is 8 percent of total water supply in Singapore but 58 percent in Manila and about 40 in most Latin American cities. For Latin America as a whole, such water losses cost between $1 billion and $1.5 billion in revenue forgone each year.
- The number of employees per 1 000 water connections is between two and three in Western Europe and about four in a well-run developing country utility (Santiago, Chile), but between ten and twenty in most Latin American utilities. " (Serageldin 1994, p11)

The cost of the wasted water brought to the city must of course still be paid for by those receiving the service, which drives up the price to them. Or it must be met by increased subsidies, which increases the burden on tax-payers and/or increases the national debt.

"The financial performance of water and sewerage agencies is equally poor and, as shown [in Figure 9.1], much worse than for other infrastructure sectors. A recent World Bank review showed that public

utilities in developing countries seldom recovered all of their costs from users. The shortfalls have to be met by large injections of public money. in Brazil between the mid-1970s and the mid-1980s, about $1 billion of public cash was invested in the water sector annually. The federal subsidy for water and sewerage services to Mexico City amounts to more than $1 billion a year, or 0,6 percent of gross domestic product (GDP). The overall picture is clear - most public water utilities in developing countries are high-cost, low-quality producers of services.

.....Compounding this already formidable picture is the fact that sewerage services in developing countries have been managed with even less efficiency than water services. In Accra, for instance, only 130 connections were made to a sewerage system designed to serve 2 000 connections. And in Mexico it is estimated that less than 10 percent of sewage treatment plants are operated satisfactorily." (Serageldin 1994, pp12 & 13)

Collecting and treating sewage is a very expensive business. Typical investment costs for waterborne reticulation are of the order of $ 1000 per residential site. Treatment costs typically increase the cost to about $1 500, just for primary treatment. In terms of the new agenda of environmentally sustainable development, for higher levels of treatment (as now mandated in industrial countries), costs are much higher. The costs of meeting the new agenda can be huge. To cite just one example, it is estimated that the United Kingdom will have to invest about $60 billion in wastewater treatment over the next decade in order to meet the new European water quality standards. This amounts to more than $3 000 per household. (Serageldin 1994, pp12 & 13.) Biswas asked if "pricing [should] include external costs like environmental and social damages? If so, how should these costs be calculated?" (Biswas 1991, p 143.)

9.5 Price

It is noted above that many poor people pay much more per litre for water than middle and high-income people do, that this is usually for water of inferior quality. In addition, it is usually forgotten, the poor have to resort to treating this water that is of suspect quality; for example, it has to be boiled, which consumes time and costly fuel.

Meantime, the upper and middle classes receive water with greater convenience at less cost per litre.

When reticulated water is made available, it is invariably underpriced. Pricing reticulated water well below its economic value is prevalent throughout the world. In many countries, expanding the supply is politically expedient, and therefore pricing and demand management have received much less attention. Some examples of this have emerged from the former Soviet Union. (Box 9.3)

"The preference for expanding supply has led to investments in infrastructure that could have been avoided or postponed and that have increased the pressure on water-dependent ecosystems. Farmers in both industrial and developing countries often pay little for their publicly supplied irrigation water. They have few incentives to refrain from growing water-intensive crops or to conserve water. ..... Similarly, many towns and cities charge fees that provide no incentive to conserve water; some charge nothing. A recent review of Bank-financed municipal water supply projects found that the price charged for water covered only about 35 percent of the average cost of supply, and charges in many irrigation systems are much less.

As a result of underpricing and other distorting policies, the value of water differs greatly among various uses in industrial and developing countries, often indicating gross misallocations if judged by economic criteria. In particular, agriculture, which absorbs the lion's share of water, often includes low-value uses per cubic metre compared with higher-value domestic and industrial uses. In California, for example, reallocating water from two agricultural areas to the metropolitan areas of San Francisco and Los Angeles would yield economic benefits of about $2 billion in 1990-2000." (World Bank 1993b, pp30 & 31)

There is small but increasing interest in demand management in the water sector, as a complement to or substitute for supply expansion. Pricing and other instruments deserve more attention relative to "command and control" methods than has been the case, particularly in developing countries. While the use of mandatory instruments may be necessary in crisis situations, price-based instruments aim at crisis avoidance over the longer term. (Garn, World Bank, personal communication, 1994)

Aside of price being more realistically aligned to cost, price (tariff) structures can be used as a means of demand management at the level of the individual consumer.

"In order to protect the interests of low-income consumers, who generally have a low consumption, there should be a "social tariff" that prices the first block of consumption, which corresponds to basic needs, very cheaply; thereafter, each block of consumption should become progressively more expensive. Usually, it is assumed that only the first block of consumption is consumed in low-income households which are not, therefore metered and, so, pay the minimum tariff, irrespective of actual consumption (zone metering and in-line flow limiters can be used to measure and limit actual consumption).

One example of a social tariff is the following which was introduced in the state of Mato Grosso do Sul in southern Brazil in September 1993.....

The first category is the charge for unmetered yard-tap supplies. The costs per m^3 of water at the upper margin of consumption in the first three categories (i.e., 10, 15 and 20 m^3 per month) are $Cr50, $Cr54 and $Cr75.5 respectively, and $Cr91 for a consumption of 25m^3 per month, so the tariff becomes very progressive above a consumption of 15 m^3 per month. It is also a very social tariff, since 65 percent of the population served is in the first few categories."

..... It is clearly in metered consumers' interests to reduce their demand, so that they pay less, but only if the resulting reduction in charges is attractive; that is, it must represent a significant sum of money. What constitutes "significant" in this context, of course, varies greatly. In the above example for Brazil, there is little incentive for the rich to reduce consumption since even the highest charge is so small a proportion of their income. .....An effective pricing policy, directly aimed at individual water conservation, is to place a high surcharge on consumption in the highest consumption block." (UNCHS 1989, pp35&36)

There is some evidence of water supply systems being used to generate substantial economic rent for water vendors. (Lovei and Whittington 1991.)

9.6 Affordability

Franceys and Cotton , when considering the need to provide all in the urban areas of developing countries with "acceptable" services, noted that, at 1992 prices:

"If conventional infrastructure standards are adopted, with household water supply, sewerage, drainage, solid waste collection, drainage and surfaced roads, the total annual cost per household (discounted lifecycle costs) is in the region of $133 for these services based on costs from a sample project in South-east Asia. This figure does not necessarily represent the amount which a household has to pay in order to obtain these services but it does represent the amount which has to be paid by somebody, either through subsidies to a utility or other cross-subsidisation through taxation of richer households in addition to user tariffs. .....

Taking assumed minimum standards for a simple house suggests an annual cost per household of $100. Adding this figure to the amount required for conventional services indicates a cost of $233 per household..... However, the total annual income per household for the poorest 40 percent of the population in the "Low-Income Countries" is approximately $700. With affordability normally estimated in the region of 20 percent for housing and services the total available annual expenditure is $140. It should be noted that this is a generous affordability percentage as studies show that the poorest can afford to spend least, even as a percentage.

[The $233 per household] is substantially in excess of presumed affordability. [Furthermore] the normal solution of cross-subsidisation within a country is difficult where income-distribution figures indicate such a high percentage of low-income households." (Franceys and Cotton 1993, pi)

By far the most usual means to increase affordability of conventional infrastructure is for households to share service connections and, hence, the cost of these.

Most poor households, if left to their own devices, select what to them is "affordable", in the form of lower levels of service.

9.7 Willingness to pay

Some mechanism has to be available to enable consumers to demonstrate what they are willing to pay for. Too many schemes have imposed a level of convenience that people are not willing to pay for. This usually leads to refusal to pay, and thence to a lack of maintenance and subsequent failure in some way of the infrastructure. Alternatively, payment terms have been set such that low-income householders are excluded from the services, or that, even through initially on serviced sites, consumers unable to pay at some point abandon the sites and live elsewhere.

Willingness to pay for an improved service is primarily influenced by -

- consumers' perception of benefit received from the improved service, especially in comparison with the service (and its price to them) that they currently have (Box 9.4); and
- consumers' perception of the reasonableness of the new tariff.

In respect of the former, White pointed out that resistance to paying for proposed reticulated services could arise if the intended beneficiaries had invested in alternatives or partial alternatives, for example, water storage tanks or septic tanks. (White, International Partnership, personal communication, 1993.)

Boxes 9.4 and 9.5 give instances of this important field of research into willingness to pay, aside of affordability or political agendae, that has received minimal attention in South Africa. The Box 9.5 studies focus on perception of benefit, and to a lesser extent, on perception of tariff reasonableness (as reflected in their reaction to deteriorating service).

However, even when international agencies intervene, and whereas many projects have been successful, others have failed to meet the needs of the intended beneficiaries. Evidence of the failures lies in the unused and poorly maintained systems that are scattered throughout the developing world. The World Bank refers to this type of situation as a "low-level equilibrium trap". (See Box 9.5.) For

example, a water system provides a low level of service with few yard taps. The monthly tariff for water from household connections is low. With few connections and low tariffs, little revenue is generated. Even with the help of subsidies provided by the government, the water authority can afford to maintain the system only up to a level at which the reliability of service is low. Households grow reluctant to pay for this unreliable service. The analyses show that by making a few critical policy changes, encouraging private connections and financing those connections through higher tariffs, the system can ratchet up to a "high-level equilibrium" in which there are many connections, monthly revenues are greatly increased, and consumer welfare improves. Such a system would be better financed, making it possible to improve the reliability and quality of the service.

Finally, willingness to pay is also heavily influenced by consumers' perception of the willingness of and ability of the supplier (ie seller of the service) to bill the consumer, to collect the revenue, and to penalise those who do not pay. As indeed is described in the case studies of Section 6.2.2.

9.8 Spending on water and sanitation

"Two recent assessments by the World Bank provide a clear overview of public financing for the water and sanitation sector in developing countries over the past three decades. As shown [in Figure 9. 2], the proportion of GDP invested in water supply and sanitation rose from about 0.25 percent in the 1960s to about 0.45 percent in the 1980s. Furthermore, although it was widely believed that the allocation to the sector fell during the difficult years of the late 1980s, a World Bank analysis of information from public investment reviews in twenty-nine countries showed a different picture. Overall public investment [i.e. total for all sectors] did indeed decline from 10.9 percent of GDP in 1985 to 8.7 percent in 1988, but over the same period investment in water and sanitation held virtually constant about 0.4 percent of GDP.

Especially where formal institutions perform least adequately, a large, informal, private sector industry has arisen to meet those needs that are not adequately serviced by formal institutions. In Jakarta only 14 percent of the 8 million people living in the city receive piped water directly. About 32 percent purchase water from street vendors, and the remaining 54 percent rely on private wells. There are in the city more than 800 000 septic tanks, installed by local contractors, fully financed by households themselves, and maintained by a thriving and competitive service industry.

In cities throughout the developing world households cope with the unreliability of formal water supply service by building in-house storage tanks, installing booster pumps (which can draw contaminated groundwater into the water distribution system), and sinking wells. In Tegucigalpa, Honduras, the amount spent on such investments would be enough to double the number of deep wells currently

providing water to [the formal water supply to] the city. The size of this informal and often hidden water economy often dwarfs the size of the visible water economy. In Onitsha, Nigeria, for instance, revenues collected by water vendors are about ten times the revenues collected by the formal water utility!

In rural areas, too, the hidden water economy is often huge. In Pakistan more than 3 million families have wells fitted with pumps, many of which are motorised. The wells are paid for in full by the families, and all equipment is provided and serviced by a vibrant local private sector industry.

The degree of distortion involved in ignoring the informal provision and financing of water sector services varies greatly by level of development (as is obvious from the examples discussed). For prosperous urban areas formal services are the norm; for low-income countries the formal services may be totally dwarfed by the informal sector, especially in rural areas, but even in some cities. What is critical is the realisation that this hidden water and sanitation economy is extremely important in terms of both coverage and service. The informal sector offers many opportunities for providing services in an accountable, flexible way. When this is not possible because of economies of scale, service by the informal sector offers a major source of supplementary financing that can be redirected if the formal services can become more responsive to consumers' demands and perform in an efficient and accountable way.

The existence of the hidden water and sanitation economy has important implications for service provision. First, there is a high demand for services that has not been met successfully by the formal sector. Second, although some services are provided efficiently by the informal sector (as by tubewells in Pakistan), in other cases, such as water vending in the urban periphery, the costs of service are exorbitant. This is in large part attributable to the inability of informal providers to take advantage of the large economies of scale involved in transmitting water by pipe rather than by person or vehicle.

The specific implication for the formal sector is profound and clear: there is an enormous reservoir of resources that can be drawn on at reduced costs for all. This can happen when the formal sector is able to meet consumer demand and provide its services in a responsive, accountable way." (Serageldin 1994, pp13-15) (Also Box 9.1.)

"The performance and sustainability of water and sanitation services depend not only on the level of financing for these services but also on the sources of such financing. Experience shows unequivocally that services are efficient and accountable to the degree that users are closely involved in providing financing for them. Or, stated another way, deficiencies in financing arrangements are a major source of the poor sector performance described earlier.

A World Bank analysis has assessed in detail the sources of financing for water and sanitation projects assisted by the World Bank. Internal cash generation in efficient, financially sustainable utilities is high - 67 percent in a World Bank-assisted water and sewerage project in Valparaiso, Chile, for example ..... Africa has the longest way to go, with utilities and local government providing only 17 percent of investment financing." (Serageldin 1994, pp15 & 16)

9.9 Sustainability (including discussion of subsidies and the collection of revenue)

9.9.1 Assignment of costs in relation to benefits, so that consumers receive services that they want and are willing to pay for, thus ensuring financial sustainability.

The economic cost of providing water comprises (i) the financial costs of abstracting, transporting, storing, treating, and distributing the water and (ii) the economic cost of water as an input.

"The latter cost arises because when water is taken, for example, from a stream for use in a city, other potential users are denied the possibility of using the water. The value of the most valuable opportunity foregone (known technically as the "scarcity value" or "opportunity cost") constitutes a legitimate element of the total production cost of water. In the most appropriate forms of water resources management (discussed below), charges based on the opportunity cost are levied on users. (As an empirical matter, the financial costs of water supplies to urban consumers and industries usually greatly exceed the opportunity costs. For low-value, high-volume uses - specifically, in irrigated agriculture - the relationship is frequently just the opposite; opportunity costs are a considerable fraction of total costs, especially in situations of water scarcity.)

What of the benefit side? The provision of water supply to households carries several benefits. Households themselves value a convenient, reliable and abundant water supply because of the time savings, amenity benefits, and, to a varying degree, health benefits. Because these "private" benefits constitute the bulk of the overall benefits of a household water supply, the public finance allocation principle dictates that most of the costs of such supplies should be borne by householders themselves. When this is the case, households make appropriate decisions on the type of service they want (for example, a communal tap, a yard tap, or multiple taps in the household). The corollary is that because this is principally a "private good", most of the financing for the provision of water supply services should be generated from user charges sufficient to cover the economic costs of inputs (including both the direct financial cost of inputs such as capital and labour and the opportunity cost of water as an input)." (Serageldin 1994, pp18&19)

The benefits from improved sanitation, and therefore where the costs should be borne, are more

complex. Households place high value on sanitation services that provide them with a private, convenient, odour-free facility which removes excreta and wastewater from the property or confines it appropriately within the property.

"However, there are clearly benefits that accrue at a more aggregate level and are therefore "externalities" from the point of view of the household. At the next level, the block, households in a particular block collectively place high value on services that remove excreta from the block as a whole. At the next level, the neighborhood, services that remove excreta and wastewater from the neighborhood or that render these wastes innocuous through treatment are valued. Similarly, at the city level the treatment of wastes or their removal from the environs of the city is valued.

Cities, however, do not exist in a vacuum; the wastes discharged from one city may pollute the water supply of a neighboring city. Accordingly, groups of cities (and farms and industries and others) in a river basin perceive a collective benefit from environmental improvement. Finally, because the health and well-being of a nation as a whole may be affected by environmental degradation in a particular river basin, there are sometimes additional national benefits from wastewater management in a particular basin.

The fundamental axiom of public financing prescribes that costs be assigned to different levels in this hierarchy according to the benefits accruing at different levels. This would suggest that the financing of sanitation, sewerage, and wastewater treatment be approximately as follows:

- Households pay the bulk of the costs incurred in providing on-plot facilities (bathrooms, toilets, on-lot sewerage connections).
- The residents of a block collectively pay the additional cost incurred in collecting the wastes from individual houses and transporting them to the boundary of the block.
- The residents of a neighborhood collectively pay the additional cost of collecting wastes from blocks and transporting them to the boundary of the city (or of treating neighborhood wastes).
- The residents of a city collectively pay the additional cost of collecting the wastes from blocks and transporting them to the boundary of the city (or of treating the city wastes).
- The stakeholders in a river basin - cities, farmers, industries, and environmentalists - collectively assess the value of different levels of water quality within a basin, decide on the quality they wish to pay for, and determine the distribution of responsibility for paying for the necessary treatment and water quality management activities." (Serageldin 1994, pp 19 & 20.)

"In practice, of course, there are complicating factors to be taken into account (including transaction costs of collection of revenues at different levels and the interconnectedness of several of the

benefits). What is striking, nevertheless is that the most innovative and successful forms of sector financing (and service provision) follow the above logic to a remarkable degree.

[Box 5.3] described the financing of sewerage services in an informal urban settlement in Karachi. In this case households pay the costs of their on-lot services; blocks pay the cost of tertiary sewers; blocks pool their resources to pay for neighborhood (secondary) sewers; and the city (via the municipal development authority) pays for trunk sewers. This evocative distinction between feeders and trunks is now being applied on a much larger scale to the provision or urban services in Pakistan.

The arrangements for the financing of condominial sewers by the urban poor in Brazil [Box 5.4] follow similar lines: households pay on-lot costs, blocks pay for the block sewers (and decide what level of service they want), and the water company or municipality pays for the trunk sewers." (Serageldin 1994, p 20).

Even when the appropriate financing and institutional principles are followed, difficult issues arise with respect to financing wastewater treatment facilities. In industrial countries it is possible to discern two models that have been used.

"In many industrial countries the approach has been to set universal standards and then raise the funds necessary for financing the required investments. As is becoming increasingly evident, such an approach is turning out to be financially infeasible, even in the richest countries. .... The US National Academy of Sciences has advocated rescinding the "secondary treatment everywhere" mandate and developing an approach in which both costs and benefits are taken into account in the management of sewage in coastal areas.

In a few countries a different model has been developed. Institutional arrangements have been put into place that do three things: they ensure broad participation in the setting of standards and in making the tradeoffs between cost and water quality; they ensure that available resources are spent on those investments which yield the highest environmental return; and they use economic instruments to encourage both users and polluters to reduce the adverse environmental impact of their activities. ..... [Case studies, in Germany and France,] show how resources for wastewater treatment and water quality management are raised from users and polluters in a basin and how stakeholders - including users and polluters as well as citizens' groups - are involved in deciding the amount of resources to be raised and the level of environmental quality to be "purchased".

There is growing evidence that if such workable, participatory agencies were developed, people in developing countries would be willing to pay substantial amounts for environmental improvement. .....

[However], even rich countries manage to treat only a part of their sewage; only 52 percent of sewage is treated in France and only 66 percent in Canada. Given the very low starting points in developing countries - only 2 percent of wastewater is treated in Latin America, for example ..... developing countries face an awesome challenge. The old agenda - the provision of water supply and household sanitation services - is clearly a relatively "easy" task if sensible financial policies are adopted, since consumers want and are willing to pay for these services. Yet only a handful of developing countries have been successful in carrying out this "easy task" in an efficient, responsive, and financially sustainable way. The new agenda, which centers on management of wastewater and the environment, is a much more difficult and expensive undertaking, and one in which successes (in terms of efficency and financial sustainability) are few and far between even in industrial countries." (Serageldin 1994, pp22-25)

9.9.2 Accountability and cost recovery

However, setting prices at the "right level" is not enough; prices need to be paid if they are to enhance the efficient allocation of resources and ensure the financial sustainability of the service.

"The record of non-payment and non-collection of fees for water is long and well documented. It reflects two problems: weak incentives to collect and limited willingness to pay because services are poor. In many cases, the record of noncollections can be attributed to the lack of political determination to enforce collections and the limited motivation of agencies to collect, since they are not required to cover their costs. Not only have water charges been neglected, but so has cost recovery for services such as flood control, drainage, and sewage treatment. Failure to recover costs and reinvest in the systems leads to a vicious cycle whereby service declines with collections - as spare parts and essential materials run out - and consumers, in turn, become less willing to pay for the poor quality services provided. Conversely, high collection rates often reflect decentralised management and enforced financial autonomy and accountability of water entities, which in turn deliver high-quality services for which consumers are willing to pay. Guinea provides a striking example of the scope that exists for rapidly breaking a vicious cycle by reorganizing the sector. Eighteen months after responsibility for supplying urban areas with water was turned over to a private supplier, the collection rate had improved from 15 to 70 percent, and service had likewise improved markedly." (World Bank 1993b, pp54 to 55)

Furthermore, "to stimulate economizing on water consumption, there must be a clear relationship between quantities consumed and amounts owed by consumers. To ensure this, water meters, in conjunction with progressive water tariffs, are essential." (Wegelin and Borgman, 1995, p140)

9.9.3 Safeguarding equity; also the topic of subsidies

The need for equity dictates that account be taken of the situation of the poor. The justification usually offered for the subsidisation of water and sanitation is the low ability of poor people to pay.

However, in developing countries it is in practice the better-off, not the poor, who virtually always benefit disproportionally from subsidised water and sanitation services. As described earlier, unserved people, particularly those in urban areas, pay much higher prices for water. And it is the poor who are the unserved.

A detailed assessment of who benefits from public subsidies of water supply and sanitation services in several Latin American countries showed that -

(i) The subsidy of water supply, expressed in terms of subsidy to the "rich" as a proportion of subsidy to the poor, ranges from 3:1 for Dominican Republic (the poorest of the countries surveyed) to near-parity (slightly in favour of the poor) in Uruguay, the richest of the countries surveyed. That is, in the Dominican Republic the rich are subsidised three times as much as are the poor. (It is not clear if this is per household or per capita.)

(ii) The subsidy of sewerage expressed, in the same terms, ranges from 8:1 for Dominican Republic to 1,5:1 for Costa Rica and 3,5:1 for Uruguay. (Serageldin 1994, pp26&27)

"The results are striking and the conclusions clear - although subsidies are justified as "being necessary because poor people cannot afford to pay," they end up heavily favouring the rich, with the inequity directly related to the degree of rationing of the service. Inequity is, accordingly, greater in low-income countries, and greater for sewerage than for water supply.

The cycle is clear. Where services are heavily subsidized, service expansion is relatively slow, both because the available resources are used inefficiently - which can be traced to the supply organizations not being directly accountable to their consumers - and because of constraints on public financing. The consequence is that "the lucky ones" get subsidized services, while the "unlucky ones", who are not served, pay an exorbitant human, social, and financial price to get services. Data from Latin America [quoted above] provide confirmation of the universal rule that "luck" is not a random outcome but is the prerogative of the privileged. These data also show that inequities are greatest where services are most heavily rationed: in the poorest countries, and for sewerage. (This has appropriately been termed "the hydraulic law of subsidies" - the subsidies go with the service, and it will always be the better off and more influential who, public pronouncements notwithstanding, benefit

first. And it will always be the less influential - the poor - who are at the end of the line both literally and figuratively, and who do not get services or suffer most from poor-quality services.)

If subsidized services do not make sense, does it follow that we should abandon the poor? The answer is an unequivocal no. Although subsidies often (as in the above case) work perversely in practice, the transfer of resources to poor people is obviously a legitimate and desirable instrument of public policy. The key is to resist the temptation to earmark those transfers for particular types of services (which the poor may or may not value). Once again this comes down to the question of trusting people - even poor people - to know how to best spend the resources available to them. In practice, then, where block grants are made to poor communities, the communities themselves can choose whether to use the funds for water and sewerage services. This practice is becoming fairly widespread with the social development funds that have become common in developing countries in recent years." (Serageldin 1994, pp 27-20.)

Alternatively: "In practice, a balance must be struck. There are enough externalities in water supply for government or donor investment to have a role, but there are also opportunities and good reasons for user charges. The relative importance of each is ultimately a political decision, whether for water supply or for sanitation. The greater interest of politicians in water supply often helps to ensure a subsidy. It certainly means that the setting of water charges is seldom left to the specialists." (Cairncross 1992, p42.)

"The poor often face considerable difficulties in raising the capital required for the intial costs of connecting to a piped water supply system. Studies in India and Pakistan have shown that connection rates can be increased substantially if water companies provide financing (not subsidies) to poor customers for the costs of connecting to piped systems. The experience of the Grameen Bank in Bangladesh shows that more people - especially poor people - will make use of improved supplies if supply agencies can help consumers in spreading intial costs over time. This practice of amortizing the costs of connections over, typically, five years has met with considerable success in Latin America for many years." (Serageldin 1994, p 29)

9.10 Chapter 9 conclusions

The conclusions are, briefly, that -

- the poor, in the developing world's urban areas, invariably have lower levels of access and poorer quality of water, and pay prices per unit that are very much higher (up to 20, 40 or even 100 times) than prices per unit paid by those better off;

- the situation with respect to sanitation is not dissimilar, but price varies more with access than with household income as such;
- for a water or sanitation service to be financially sustainable, consideration must be given to the affordability both at the household level and (especially if subsidies are contemplated) at the national level;
- social objectives can and often do influence the price of water or sanitation;
- costs of water and sanitation services are typically rising, due to reasons which may include: the infeasibility of low-cost solutions as urban densities increase; increasing aspirations of users; national scarcities; mismanagement of resources;
- "the next project" can be two to three times the unit cost of the last project;
- most public sector water and sanitation providers in developing countries are high cost and inefficient;
- reticulated water is typically underpriced; for this and other reasons, demand management has received too little attention;
- a "social tariff" can price a level of consumption that corresponds to basic needs; thereafter, each higher block of consumption can be made more expensive;
- cross-subsidation of service prices is difficult in areas which have high proportions of low-income households;
- willingness to pay for an improved service is primarily influenced by consumers' perception: of benefit (especially in comparison with their present service), of the reasonableness of the new tariff, and of the willingness of and ability of the supplier to bill and then to penalise those who do not pay;
- "too many" schemes have imposed a level of convenience that people are not willing to pay for, and hence they don't pay; an early consequence is often a financially strapped and deteriorating service;
- especially where formal institutions perform least adequately, an informal private sector water and sanitation industry (sometimes the households themselves) has arisen to meet the needs; the size of this informal sector often exceeds the size of the formal economy;
- there is substantial evidence that "services are efficient and accountable to the degree that users are closely involved in providing financing for them";
- the opportunity cost of water constitutes a legitimate element of the total cost; for low-value high-volume uses, opportunity costing is a considerable fraction of the total cost;
- most recent World Bank opinion is that costs should be borne by different geographic areas accruing to the benefits accounting to each area; for example, households individually should pay the costs of providing on-plot facilities, whereas neighbourhood residents should collectively pay the additional costs of collecting wastes from their area and transporting them to a distant place or treating them;

- setting prices at the "right level" is not enough; prices need to be paid if they are to enhance the efficient allocation of resources and ensure the financial sustainability of a service;
- non-payment and non-collection of fees for water and sanitation reflect problems that include weak incentives to collect and limited willingness to pay because services are poor;
- failure to recover costs and reinvest in the systems leads to a vicious cycle whereby service declines with collections - as spare parts and essential materials cannot be afforded - and in turn, consumers become less willing to pay for the falling quality;
- in developing countries it is in practice the better-off, not the poor, who usually benefit disproportionately from subsidised water and sanitation services;
- there is substantial evidence that, rather than subsidising services, the poor are better helped by means such as block grants to communities and small loans for capital improvements to individual households.

9.11 Notes on additional references

- For more on affordability and willingness to pay , see -
  - Whittington, et al 1989
  - Whittington, Lauria and Mu, 1991
  - Velasco and CEDATOS, 1991
  - Whittington, Smith, et al 1992
  - Whittington 1992
  - Altaf, Jamal and Whittington, 1992
  - Whittington, Okorafar, Okore and McPhail, 1992
  - McPhail, 1993
  - Singh et al 1993
  - Bohm, Essenburg and Fox, 1993

- For more on matching supply and demand, using data on willingness to pay, see -
  - Lauria 1994

- For more on the components of cost, see -
  - Chapter 12 of Tayler and Cotton 1993

- For indicators of and case studies of project (not only water and sanitation project) sustainability, see -
  - Bamberger and Cheema 1990.

Box 9.1 What do the poor pay for water?

"Several studies show that the urban poor pay high prices for water supplies and spend a high proportion of their income on water. For example, in Port-au-Prince, Haiti, the poorest households sometimes spend 20 percent of their income on water; in Onitsha, Nigeria, the poor pay an estimated 18 percent of their income on water during the dry season compared with upper-income households who pay 2 to 3 percent; and in Addis Ababa, Ethiopia, and in Ukunda, Kenya, the urban poor spend up to 9 percent of their income on water. In Jakarta, Indonesia, of the 7,9 million inhabitants, only 14 percent of households receive water directly from the municipal system. Another 32 percent buy water from street vendors, who charge about $1,5 to $5,2 per cubic meter, depending on their distance from the public tap. In some cases, households purchasing from vendors pay as much as twenty-five to fifty times more per unit of water than households connected to the municipal system. Some examples of this phenomenon are found in Karachi, Pakistan; Port-au-Prince; Jakarta; Nouakchott, Mauritania; Dacca, Bangladesh; Tegucigalpa, Honduras; and Onitsha."

(World Bank 1993b, p31.)

Box 9.2 The increasing costs of supplying water

"Many cities convey water over long distances and use high-cost pumping extensively. In addition, intensive use of water has created the need for additional treatment because the quality of the new source is poor or the original source was rejected because the damage to its quality was irreversible. In the following examples the figures do not include the cost of treatment and distribution.

- Amman, Jordan. When the water supply system was based on groundwater, the average incremental cost was estimated to be $0.41 per cubic meter, but chronic shortages of groundwater led to the use of surface water. This raised the average incremental cost to $1.33 per cubic meter. The most recent works involve pumping water up 1 200 meters from a site about 40 kilometers from the city. The next scheme contemplates the construction of a dam and a conveyor, at an estimated cost of $1.50 per cubic meter, which is also about the cost of desalinating seawater, $1 to $2 per cubic meter.

- Shenyang, China. The cost of new water supplies will rise from $0.04 to $0.11 per cubic meter, almost a 200 percent increase, between 1988 and 2000. The main reason is that the quality of groundwater from the Hun Alluvium, the current water source, is not good enough for potable water. As a result, water will have to be conveyed to Shenyang by gravity from a surface source 51 kilometers from the city. In Yingkou the average incremental cost of water diverted from the nearby Daliao River is about $0.16 per cubic meter. However, because of the heavy pollution, this source cannot be used for domestic purposes. As a result, water is currently being transported into the city from the more distant Liu River at a cost of $0.30 per cubic meter.

- Lima, Peru. During 1981 the average incremental cost of a project to meet short- and medium-term needs, based in part both on a surface source from the Rimac River and on groundwater supplies, was $0.25 per cubic meter. Since the aquifer has been severely depleted, groundwater sources cannot be used to satisfy needs beyond the early 1990s.

  To meet long-term urban needs, a transfer of water from the Atlantic watershed is being planned, at an estimated average incremental cost of $0.53 per cubic meter.

- Mexico City, Mexico. Water is currently being pumped over an elevation of 1 000 meters into the Mexico Valley from the Cutzamala River through a pipeline about 180 kilometers long. The average incremental cost of water from this source is $0.82 per cubic meter, almost 55 percent more than the previous source, the Mexico Valley aquifer. The acquirer has been restricted due to the problems of land subsidence, the lowered water table, and the deteriorated water quality. The newly designed water supply project for the city is expected to be even more costly, since it will have a longer transmission line and water will be pumped over an elevation of 2 000 meters."

(World Bank 1993b, pp 36 - 37.)

Box 9.3 Getting the water price "right" in the Ukraine

"For residents of Lviv, a cobblestoned city of 850 000 residents in western Ukraine, bathtubs are a precious commodity. Most households use their tubs to store the day's supply of water. For the past 20 years, water has flowed only six hours a day. The rest of the time, families must make do with what their bathtubs can hold ...

A history of economic distortions created much of this water shortages. Residents of the former Soviet Union became used to heavily subsidized communal services, including water. However, these subsidies often weren't enough, causing systems to deteriorate. While reform-minded governments are now requiring customers to shoulder more and more of the true costs of providing water, old ways die hard. "Until two years ago, a pack of cigarettes still cost double the monthly household communal services bill in Moscow," points out PADCO Economist Eugene Gurenko. In Ukraine, charges for communal services accounted for less than 1% of the average household's income. Confronted with such problems, Lviv officials turned to USAID for help....

... In Lviv, ... the amount collected in cash may equal less than a quarter of actual costs [of providing the water service]. The cause? Internal cost estimates that do not capture full costs, poor collection levels, "in-kind" payments of products such as lamps and chairs instead of hard cash, and nonexistent enforcement mechanisms. The solution was a phased strategy for improving collections, and a tariff-setting methodology that will "get the prices right."....

Meanwhile, PADCO is supporting water sector reform elsewhere in Russia and Ukraine. In Kiev, Ukraine, PADCO's Resident Advisor .... is helping the Government stitch together their social safety net programme, which includes targeted assistance to the poor in paying for housing and communal services..."

(Kehew 1996, p7)

Box 9.4 User willingness to pay for sanitation

Low- and middle-income groups will typically spend only 2-3 percent of their income on sanitation. "This figure, of course, is a maximum; there are two important reasons why the limit for low-income groups is likely to be lower.

First, of course, the sanitation system on offer should meet their needs and be sufficiently attractive for people to want it. In practice, the ideal is rarely affordable, and any misgivings people harbor about the system will be reflected in their willingness to pay for it. Conversely, they must also be dissatisfied with their current sanitation arrangements. Second, this rule of thumb is based on the income of the *average* household; households that are poorer than this are usually obliged to spend a greater than average proportion of their income on food and consequently have a smaller portion available for sanitation.

A more specific estimate of willingness to pay may be derived from the amounts that the target population already pays for services such as electricity and water supply. However, there are three important factors to bear in mind when making such extrapolations: (a) the users may ascribe higher priority to the other services than to sanitation; (b) coverage with these services may be less than is hoped for from the sanitation program, and it may be limited to the better-off households; and (c) a large portion may have managed to evade payment.

What is surprising is that the poor may already pay more to informal suppliers than most officials imagine. For example, the amount paid to water vendors in some towns is more than the total revenue of the water supply agency. The water-supply sector could benefit from a survey of how much people already pay.

An approach that may prove to be more accurate than many analysts had supposed until recently is to ask potential users directly how much they would be willing to pay. Social researchers have often counseled against such an approach, as it involves the use of a hypothetical question which illiterate people might find hard to understand, and it may produce a biased answer if the respondents seek to manipulate the survey to their advantage. Yet the poor are perhaps more experienced than the well-off at making careful assessment of the value of things; it is a fundamental component of the careful budgeting essential to survival. And if they have an interest in giving an answer which is misleadingly low to ensure they are not charged too much for sanitation, they also have a good reason *not* to give too low a figure, lest it be determined that they do not want sanitation enough to deserve it.

A refinement of this "contingent valuation" approach is to arrive by means of a "bidding game" at an estimate of how much the consumer is willing to pay. For example, consumers are asked in sequence whether they would be willing to pay $10, $20, $50, $100 and so on until a price is reached which they are not willing to meet. By comparing the results of bidding games in which the bidding goes upwards or comes downwards, or starts at different points, it is possible to check the consistency of consumer responses. The method has been used and tested in the water-supply sector, where the results of several studies indicate that most consumers do in fact give consistent, rational responses in such exercises. It is equally suitable for the study of willingness to pay for sanitation. [See Box 9.5.]

Those expressing a willingness to pay a given price for sanitation facilities may nevertheless have difficulty raising the cash; putting credit at their disposal may speed the uptake of the sanitation on offer by the community. Indeed, loan schemes are a tempting way to bridge the gap between willingness to pay and the construction cost of the latrines that are being promoted, especially where funds for the sanitation program are provided by a lending agency.

continued

Provision of credit to householders to install sanitation facilities is subject to the same considerations as credit schemes for other housing improvements, and a considerable amount of literature is available on that subject. There are serious difficulties in ensuring that credit is really [sic? "readily"?] available to low-income groups, while ensuring a satisfactory rate of repayment. In India, where commercial banks are required by law to devote a certain amount of their income to such credit, the default rate is so high and debt recovery so expensive that the banks usually write off these amounts as being, in effect, given away.

There are low-cost housing schemes where only a small minority of households have fallen into arrears in their loan repayments, but low default rates have often been achieved by careful preselection of participants. Where such selection criteria are applied or where firm security is required from those seeking loans, those most in need -- female-headed households, for example — may be deterred from applying. Households that have difficulty managing their food budget from one week to the next are unlikely to want to go into debt for housing improvements, and still less for a latrine ...

Loans to householders [are one] way to recover the cost of sanitation schemes while cushioning residents from the high initial capital investment such schemes may require.The capital cost of conventional sewerage projects is not normally paid out in cash by householders but financed through the sewerage agency and recovered over several years in a tariff or from a municipal rate or tax. Mechanisms of this kind have been used to recover the cost of on-site sanitation, especially in site and service schemes such as those in urban Botswana and Kenya. Households are allocated a plot which is already provided with basic services such as water supply and a pit latrine, and can then build their own house on it. The cost of the services is then recovered in a monthly land rent or plot charge. Since the plot charge can be levied with the sanction of eviction, and since plot owners can sublet part of their plot to augment their income if necessary, default rates tend to be low."

(Cairncross 1992, pp 36 - 39)

Box 9.5 Case studies of consumers' willingness to pay

A. Brookshire and Whittington

"In the following set of papers, the authors utilize benefit valuation methods to determine what are the benefits of various types of projects....

North and Griffin focus on a region of the Philippines and .... the relative valuation households place on differing types of water sources. Thus they are attempting to value alternative types of infrastructure for providing water supply. As part of the effort, they investigate the role that distance to a public or communal source has on households' willingness to pay. They find that a piped-in source is valued high relative to other characteristics of the home. They suggest that the development of more communal sources should be second priority relative to in-house piping.

Singh et al address the issue of how to get better service and more yard taps. The contingent valuation method is used to evaluate the possibility of improving the overall performance of the systems. The setting is three areas of Kerla, India. Specifically, they examine the willingness to pay for yard taps and/or house connection. They show that consumers' welfare based on responses to the contingent valuation question rises with the increase in connections and monthly tariff. Further, they argue that a critical element is the nature of the financing process for new connections focusing on the quality of the service.

Altaf et al use estimates of households' willingness to pay for piped water supplies.... They describe communities caught in a kind of "low-level equilibrium trap". In the Punjab, government-provided water systems have been designed to accommodate an estimated water use of 40 litres per capita per day. Because water connections are not metered, people demand more water than the existing piped water systems can provide. To ration available supplies, the water authority must reduce the number of hours of service. The systems thus become unreliable, and people are not willing to pay much for such poor service. Because households are not willing to pay, the water authority cannot charge realistic prices and thus does not collect sufficient revenues to manage the system properly. Without adequate funds for operation and maintenance, reliability deteriorates further.

Altaf et al show that the way out of this trap is to install meters and charge higher prices for water. Their results indicate that households' willingness to pay for reliable water supplies is much higher than is commonly assumed, and that full cost recovery is quite feasible in many areas of the Punjab."

(Brookshire and Whittington 1993, pp 1886 & 1887.)

B. Whittington, Lauria, et al

A contingent valuation survey was conducted in Kumasi, Ghana, to estimate households' willingness to pay for two types of improved sanitation services: improved, ventilated pit latrines and water closets connected to a sewer system. Over 1 200 randomly selected households throughout the city were interviewed. Most households were willing to pay more for improved sanitation service than they were currently paying for their existing sanitation system (mostly public and bucket latrines), but in absolute terms the potential revenues from households are not large, of the order of US $ 1,40 per household per month (about 1 - 2 percent of household income).

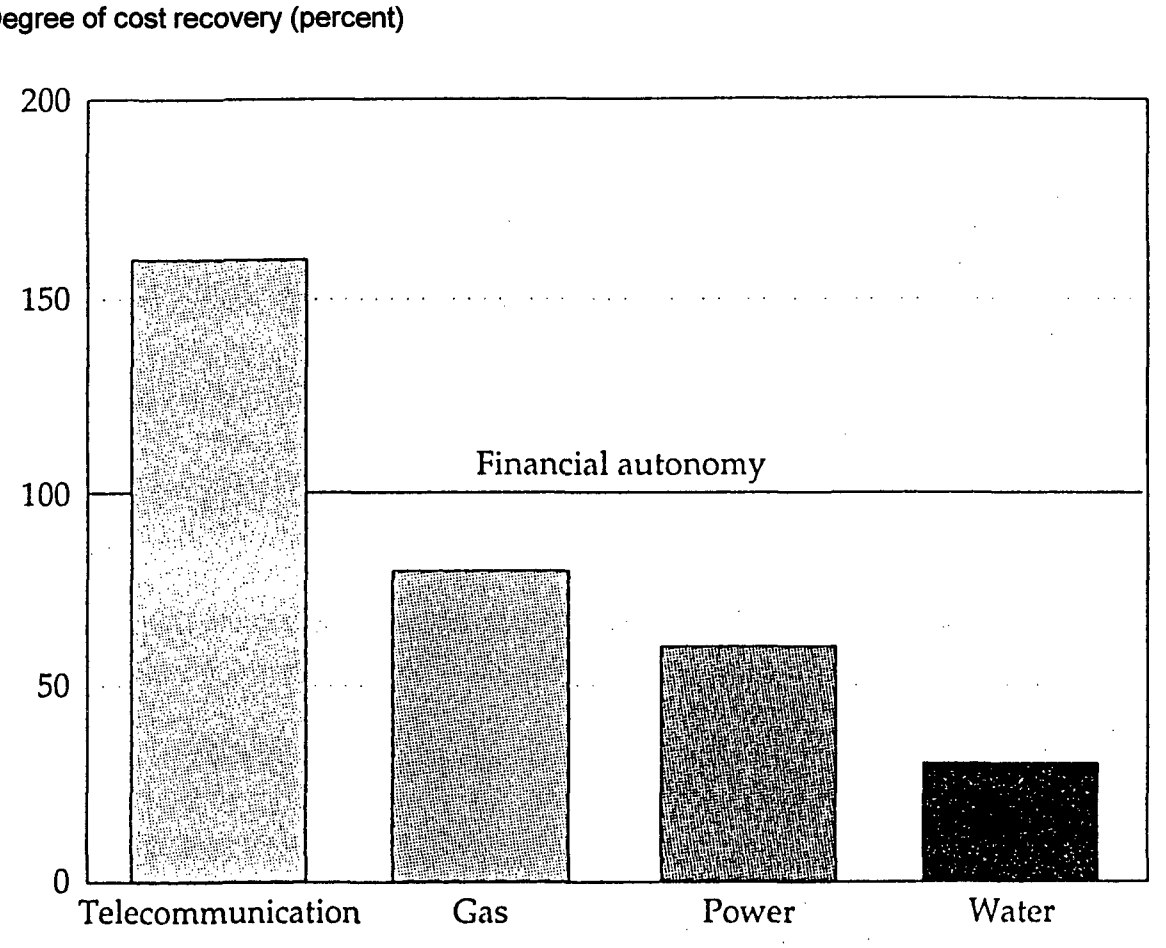
continued

The results of the study confirm the conventional wisdom that, without massive government subsides, waterborne sewerage is not affordable to the vast majority of households. On the other hand, it appears that only modest subsidies are required to achieve relatively high levels of coverage with on-site improved ventilated pit latrines (VIPs). This is because the VIP latrines are much cheaper than conventional sewerage and because most households are willing to pay about the same for a ventilated pit latrine as for a water closet connection to a sewer, and in any case they cannot afford to pay any more for sanitation.

(Whittington, Lauria, et al 1993)

Figure 9.1

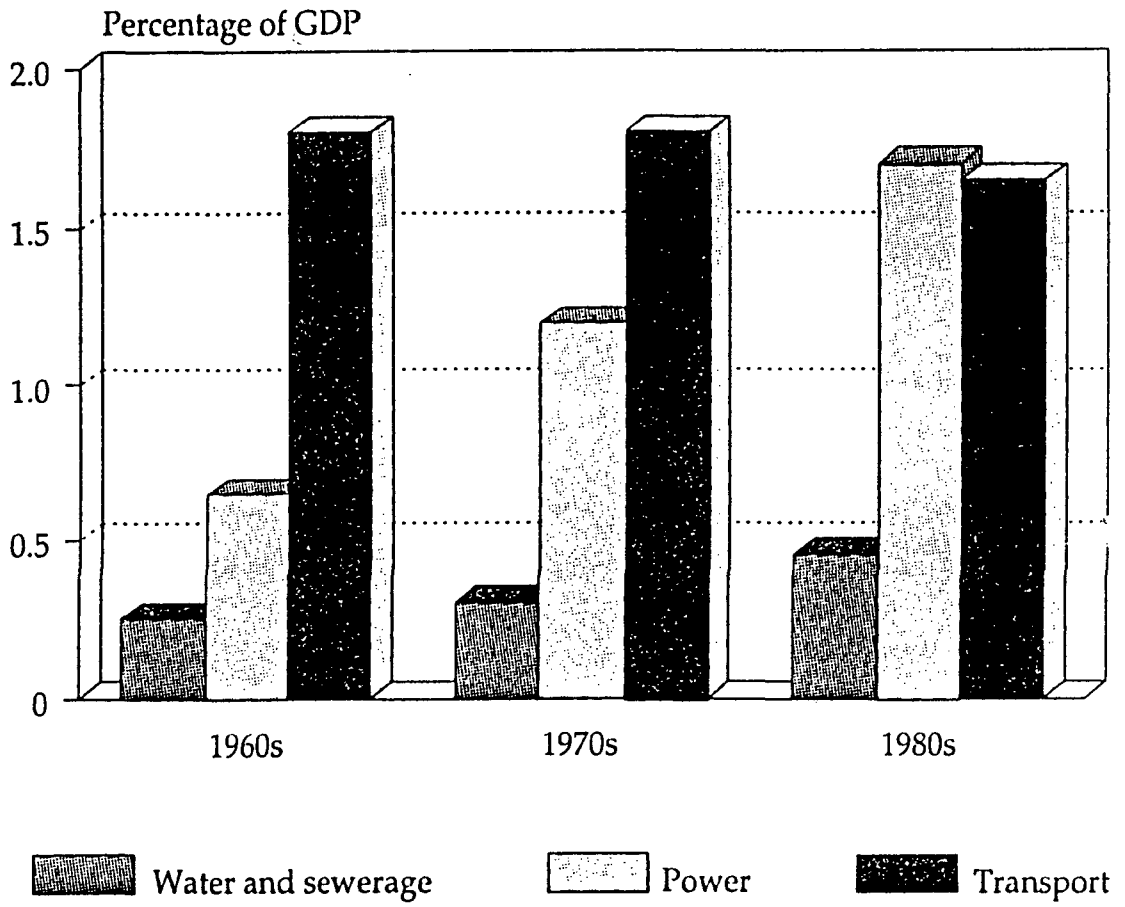
Degree of cost recovery in infrastructure sectors in developing countries



(Serageldin 1994, p11)

Figure 9.2

Public investment in infrastructure in developing countries over three decades



(Serageldin 1994, p14)

10. OVERVIEW AND SUMMARISE APPROACHES AND EXPERIENCE

10.1 Chapter 10 introduction

The preceding chapters report a changing emphasis of the international agencies involved in water and sanitation provision -

- from single focus projects (eg. focus on technology, or on preventative health, or on hygiene education), to
- more integrated approaches to the provision of infrastructure and the improvement of health.

For example: "... most of what is written about urban health problems in the Third World reveals the lack of interchange between urban specialists and health specialists. When discussing the health problems of the urban poor, medical specialists so often reveal an outdated and greatly simplified understanding of poverty and its causes and of urbanisation processes in general. They often seek explanations for poor health in poorer groups' behaviour, while missing the social, economic and political structures that are the main causes of urban poverty and poor health." (McGranahan, Mitlin and Satterthwaite 1993, p6)

It is known from other reading and discussion that this change of emphasis has not been sudden, but is part of a gradual evolution since the 1970s, and is accompanied by the agencies' other shifts in emphasis, particularly -

- from primary attention on rural issues, to primary attention on the cities;
- from top-down approaches, to approaches that are a judicious mixture of top-down and bottom-up;
- from focus on construction costs of facilities, to lifetime costs of facilities (i.e. including operation and maintenance); and
- recognition of the need to ensure the financial and environmental sustainability of projects.

As Serageldin noted, the need is to put the intricacies of water and sanitation provision into ".... a broader context. The overriding challenge to the developing world today is to improve the well-being of the poor in a way that is both environmentally and financially sustainable. Awesome as this challenge is, we can now discern an emerging consensus on what needs to be done and how to do it.

The consensus involves three key ideas. The first, the most mundane, is that the reduction of poverty depends in a fundamental way on sound economic policies, which means fiscal common sense and the maximum use of the market and market-like instruments. The second idea is one that had come

to the fore recently. It is that the only true development is one in which economic progress and environmental enhancement go hand in hand and are mutually reinforcing. The third is both fundamental and radical. It is that the people have to be not only the object but the subject of development. It is the people themselves - all the people - who have to decide what services they want; it is the people to whom service institutions have to be responsive and accountable; it is the affected people who have to make the decisions (based on information from technicians) on environmental policies and standards." (Serageldin 1994, p32)

As a result, it is necessary to reconsider the objectives of and means of providing water and sanitation.

The objectives are invariably to obtain, primarily through the built environment, health benefits, security and social requirement benefits, and convenience and status benefits. The means must be considered in the light of the circumstances. As noted repeatedly in this report, these circumstances include (examples only): other complementary projects that are under way affecting the same community, the income of the community, and the technological difficulties.

Levels of service for housing and infrastructure reflect differing costs, risks and benefits, and the decision-makers' assessment of these. However, there is confusion between objectives and means. Whilst health benefits are often used to justify investments, there is seldom evidence to suggest "what benefit" accrues from "what investment". As time passes and governments and development professionals learn (sometimes by successes, but mostly by failures), there is a tendency for levels of service to be raised. This does not necessarily mean that previous "lower" levels are "wrong", but rather that they simply carry a higher risk in health and safety terms, or maybe only that they are less convenient to users. Even high levels of service, for all their high cost, do not free communities from all risk. Therefore the means of infrastructure provision should be more consistently related to the objectives and what the weighting is of the various objectives (eg. health benefits as opposed to convenience benefits). The resources to address all these objectives are seldom sufficient, and therefore it will invariably be found that there must be trade-offs between objectives. Meeting the objectives can only be optimised - it is highly unlikely that they can all be satisfied.

In more detail:

10.2 Technological issues

It is evident from the paragraphs immediately above that the choice of level of service is essential to optimising the objectives. Technology choice is vital in achieving the correct balance of services to suit the particular circumstances at any location. Many of the technologies described in the

publications of international agencies can be used to provide effective services for the poor which are at the same time affordable and for which householders are willing to pay.

Moreover, if the scale of the technology is reduced, there is a greater potential for community-based water and sanitation systems and for private sector involvement in these systems. Small-scale, low-cost technologies are needed in the developing world. If the technology does not have major capital requirements, community groups and small private enterprises will usually be better able to provide water and sanitation services.

10.3 Institutional, legislative and financial issues

Adequate institutional provision for water and sanitation involves innovative institutional arrangements, diverse skills and capabilities, many public and private actors, and a range of tools for capacity building.

In the experience reported in the preceding chapters, particular attention is paid to the importance of institutional reform (including private sector participation) and the role of nonformal groups in ensuring that services are those which people want, and that supply institutions are responsive. Some promising directions are discussed, which could be used in appropriate circumstances. These include partnerships in which nonformal institutions (such as neighbourhood associations) manage the feeder infrastructure, while formal institutions (such as governments or utility companies) manage the bulk and link infrastructure. In many other cases this involves a much greater role for the private sector in the provision of services, via both nonformal and formal institutions. Finance must be appropriate - for example, microloans for household-scale sanitation improvement.

Other points from the experience include : Adequate operational management of urban services will go a long way toward effective financial and environmental management, through the introduction of the principles of strategic planning, accountability, efficiency, maintenance, feedback and cost recovery. Similarly, ensuring effective enforcement capacity, which requires strengthening human and technical capacity, is crucial to the success of any policy or regulation.

10.4 Economic issues

For many people in developing countries, inadequate water supply and sanitation is the most important environmental problem. More than 4 million deaths from diarrhoea alone could be avoided each year if all people had reasonable water and sanitation services. (Box 8.2). And large economic and environmental costs are incurred in trying to compensate for poor quality services.

At the project level, the economic benefits of improved water and sanitation can be substantial.

Reductions in time (especially of women) spent every day to fetch water, and in household expenditures on purchasing water, are some obvious ones. Accompanying declines in incidence of water-related sickness and diseases also have the potential of freeing scarce public resources for alternative uses. Improving the physical environment in and around the home could also motivate residents to clean, beautify and upgrade their immediate neighbourhoods. In other words, a well executed water and sanitation project targeted at low income communities can allay several development concerns simultaneously, such as -

- poverty alleviation
- environmental upgrading
- improvements in living standard of women, and
- reduction in the sickness, death and loss of productivity that is caused by unhygienic water and sanitation practices.

The economic advantages to urban productivity, through water and wastewater/sanitation provision to the commercial and industrial sector as well as to the domestic sector, can also be shown.

10.5 Environmental and social issues

In most urban centres, poorer groups face the most serious environmental hazards and the least possibility of avoiding them or receiving treatment to limit their health impact. At least 600 million urban dwellers in Africa, Asia and Latin America are estimated to live in "life- and health-threatening" homes and neighbourhoods because of environmental hazards (not all of them directly related to water and sanitation). (Satterthwaite 1993, p109)

A progression is readily discernable in which people demand, and are willing to pay for, environmental services of both the green and brown varieties, as they move up the socio-economic ladder. For example, water and sanitation services and related effects:

- The first environmental priority of a dweller in an informal settlement is to secure an adequate water supply at reasonable cost. The demand is for quantity of water, as in assurance of supply, and not having to walk too far to fetch it. This is followed shortly thereafter by the demand to secure a private, convenient, and sanitary place for defecation. Within the limits of affordability, there is a high willingness to pay for these services, in part because the alternatives are so unsatisfactory. Households put substantial pressure on local and national governments to provide such services, and it is appropriate that the bulk of external assistance

in the early stages of development goes to meeting this demand.

- However, the very success in meeting these primary needs gives rise to a second generation of demands. One example is for removal of wastewater from the household, then from the neighbourhood, and finally from the city. Another example is that the **quantity** of water supplied being satisfactory, the demand grows for improved **quality**.

- Success in this important endeavour gives rise to yet a third generation of demands: for the protection of the green environment, inter alia from the degrading effects of large amounts of waterborne waste.

In view of this, noted Serageldin, the "historic bias" of the World Bank in favour of water investment, at the expense of sanitation, is probably not only not "wrong", as is currently often implied, but actually "right". (Compare World Bank 1993b, p33, quoted on p 75 above.)

"The historical experience of industrial countries and the contemporary experience of developing countries demonstrate clearly that only when the first challenge [the provision of services] has been substantially met do households and societies pay attention to the "higher order" challenges of environmental protection. Thus it is not surprising, and not incorrect, that the portfolios of external assistance agencies have concentrated on the provision of water supply. For example, of World Bank lending for water and sanitation over the past thirty years, only about 15 percent has been for sanitation and sewerage, with most of this amount spent on sewage collection and only a small fraction for treatment." (Serageldin 1994, p6)

10.6 Cost, price and affordability issues

Governments tend to base their expenditure on water and sanitation on political and social considerations rather than on purely economic criteria. Government involvement reflects the understandable concern that relying exclusively on unregulated markets would not work. In many countries, this has led to a tradition of heavy dependence on centralised command and control administration for developing and managing water resources, and reliance on government agencies to develop, operate, and maintain water systems.

The result has often (but by no means always) been unreliable projects that produce services that do not meet consumers' needs and for which they are unwilling to pay. The absence of financial discipline and accountability for performance, along with political interference in decisions about allocations and pricing, are reflected in a litany of problems that often include: inefficient operations,

inadequate maintenance, financial losses, and unreliable service delivery.

Inadequate water and sanitation services have a particularly adverse impact on the poor, facilitating the spread of disease, especially in crowded, low-income areas. Special efforts should be directed to meeting the needs of the poor. Thus "... we need to complete the old agenda. It is clear that the bulk of financing can and should come from users. For this to happen, attention has to be given to both demand-side and supply-side factors. On the demand side there must be a rigorous focus on providing the services that people want and are willing to pay for. Above all, this means changing from the "we know best" attitude that has characterized the sector for too long, to focus on meeting households' needs as the households themselves see them. On the supply side the focus must be on developing institutional arrangements that provide services at least cost and in a way that is responsive and accountable to consumers." (Serageldin 1994, pp31&32)

Where public finance is scarce, significant additional resources can often be mobilised within local communities. Attention should be paid to ascertaining from the poor what level of services it is that they want, and then to providing a range of levels of service. Where the poor are unable to pay for an acceptable level, "social fees", whereby the better-off cross-subsidise the poor, can be used. Microloans to cover the cost of connections can also be very facilitative.

However, "...disparity in access is aggravated by the fact that formal supply is generally subsidized in a non-discriminating or insufficiently discriminating manner. As a result, well-intended subsidies on supply do not reach the lower-income groups for which they are intended. Moreover, in countries where such subsidies take the shape of water provision at price levels below provision costs, the financial sustainability of the .... system is at risk, adversely affecting network extension into areas presently unserved or not adequately served, as well as the operation and maintenance of the existing network." (Wegelin and Borgman 1995, p 140)

While not denying the importance of equity and the need to provide all people with basic water and sanitation, a recent emphasis in the international agencies has been on closer consideration of cost and price issues, and of affordability and willingness to pay, as means to ensure that services are efficient and are financially sustainable.

Many of the problems encountered in providing water services are due to the lack of incentives both for performance by providers and for efficiency by users. "A key component of the reforms to be supported by the Bank will thus be greater reliance on incentives for efficiency and financial discipline. The Bank will highlight the importance of pricing and financial accountability by using estimated opportunity costs as a guide in setting water charges. In practice, immediate adoption of opportunity

cost pricing may be politically difficult. Thus, given the low level of current cost recovery and the importance of finances in the sustainability of operations, pricing to ensure financial autonomy will be a good starting point." (World Bank Policy 1993, p14)

An essential element is an efficient billing and revenue collection system, and the penalising of defaulters. Davey found that in the case of "chargeable services, including water supply, sewerage, public transport and rental housing", a high degree of direct cost recovery (including both operation and investment cost) is generally associated with effective coverage. "High degrees of subsidy do not in practice lead to effective provision, least of all to the poor." The regular uprating of tariffs and its rigorous enforcement are important to this end. (Davey 1993, pp34 and 47. See also Fox 1994, p3)

Finally, there is a need to embark on the new agenda. Here the challenge for developing countries is enormous. "....Financial realities are forcing industrial countries to make difficult choices about how much investment to make in preserving the aquatic environment and how to spend the available resources. In developing countries the situation is much more difficult for three reasons: the challenge has to be met while the old agenda is still on the table; aquatic environmental quality is much worse in developing countries; and developing countries have far fewer resources to devote to environmental protection. What this means is that developing countries and those who support them have to confront very difficult tradeoffs and make many tough decisions." (Serageldin 1994, p32)

11. CONCLUSIONS

Success in achieving the objectives of a project depends very much on defining with the intended beneficiaries what the objectives are to be. (This sounds obvious, but is a sincere warning against not only top-down projects but also projects that are bottom-up but unfettered by realities such as resource limitation, or are the result of politicians' similarly unfettered attempts to provide what they perceive to be the demands of their constituents.)

Cairncross, in an analysis of experience gained during the International Water Supply and Sanitation Decade (the 1980s), stated that a project's designers and managers must understand that they are selling a product, and this involves regarding the beneficiaries as customers and understanding their circumstances. Community contact and consumer education are essential. It is useful to begin promotion and education efforts with an established cadre of community workers and to build the programme on the water and sanitation solutions the target community has used in the past, aiming for sustained growth rather than rapid coverage. It is better to improve an existing system in ways that are affordable, sustainable and upgradable," than to aim for a new solution that may be ideal but often proves to be unsustainable." (Cairncross 1992, pv)

Complementing this "principal lesson", and expanding to other lessons, Briscoe argued that large gains - in environmental quality, health, equity and direct economic returns - can be realised by adopting an approach that comprises four key elements:

- Managing water resources better, taking account of economic efficiency and environmental sustainability;

- Providing, at full cost, those "private" services that people want and are willing to pay for (including water supply and the collection of human excreta, wastewater and solid wastes);

- Using scarce public finds only for those services (specifically, treatment and disposal of human excreta, wastewater and solid wastes) that provide wider communal benefits; and

- Developing flexible and responsive institutional mechanisms for providing these services, with a larger role for community organisations and the private sector. (Briscoe, World Bank, personal communication, 1994)

Some other, also complementary, important lessons are:

- Provision of water and sanitation, as in the case of other services, has often been hampered by the conflict between levels of service and financial constraints. It is often not acknowledged by governments, politicians, beneficiaries or proposed beneficiaries, that this conflict reduces the potential for access by those not yet served.

- There is a need for integration of water and sanitation with other efforts to reach the same project objectives. Thus water and sanitation must be integrated with the provision of solid waste disposal, roads, stormwater drainage, flood prevention, education in water and sanitation use, primary health care, education in general health care, shelter upgrading, nutrition improvements and opportunities for earning income (this list is not exhaustive).

- Attempts to improve any aspect of water and sanitation provision must adequately address all elements, viz of technology, finance, institutional reform, social, and so on.

As an example, consider a strategy to promote incentives for adopting technologies and management approaches to make the use, allocation, and distribution of water more efficient. Water fees and fiscal incentives can encourage consumers to adopt water-saving technologies, including water reuse systems. Such technologies and management approaches make it easier to conserve water and to increase the efficiency of water use and conveyance. Besides price-based incentives to conserve water, demand management includes educational, technical, and administrative programmes. Often these are used together with price incentives to conserve water and thus limit the need for new supplies. Technological measures include flow control devices, metering, reduced line pressures and low-flush toilets. Administrative controls include rationing, restrictions on using water for certain purposes, programmes that reduce leaks in water distribution systems, and educational programmes that promote conservation.

A note on diversity is important at this stage.

It is evident that, although certain important policy and practice trends are almost universally observed, there is by no means unanimity between agencies, or even within any one agency, on all issues. There is nothing unexpected about this: indeed diversity could be welcome if it -

- encouraged periodic review of existing solutions, and brought forward fresh solutions for old problems, or
- enabled appropriate new solutions to new problems, or enabled new opportunities to be approached positively.

One could <u>expect</u> diversity in policy and practice that reflected, inter alia -

- differences, between "experts", on the same generic problem or opportunity;
- emerging, as opposed to long-established, opinions;
- different approaches to outwardly similar problems and opportunities, necessitated by the unique set of more detailed circumstances of each.

On the last point, i.e. diversity in approaches because of diversity in circumstances:

There is great variety in the range and relative importance of water- and sanitation-related hazards both within and between cities and in the other environmental hazards and the non-environmental factors that underlie or interact with them. For instance, in most major cities, the priorities for health improvement in an inner-city tenement will differ from those in a land invasion on the urban periphery. In both, environmental hazards may be major causes of ill-health, injury and premature death. But the range of hazards and their relative importance will differ because of differences in (for instance) population income level and its distribution, population age structure, quality and type of infrastructure and service provision, risk of flooding, access to health and emergency services, and a host of other factors. Therefore, city-specific and neighbourhood-specific understandings are needed of the range of environmental hazards and their relative importance for health. These must be combined with an understanding of the groups most affected by the hazards, and the diverse mix of social, economic, political and demographic factors that underlie the hazards. Only when this is done, can city- and neighbourhood-specific programmes to control environmental problems and reduce risks (especially for the most vulnerable groups) be drawn up.

There is often failure to understand this diversity within and between cities. Assumptions are made as to what are likely to be the most serious environmental problems, based on little or no data from the cities concerned. Or what had proved to be a major environmental problem in one city or neighbourhood is assumed to be the major problem in another. Or what a research project had shown to be a pressing health problem in one city (or even a few cities) is assumed to be a pressing problem in other urban centres.

None of which is to deny that, when intervening in response to a perceived environmental problem, a broad-brush scan, even of the coarsest kind, is better than nothing. Especially if a crisis is to be reacted to, emergency measures, which may draw on experience in other cities or neighbourhoods, can be implemented. Meantime the more comprehensive and, by definition, more time-consuming, situation assessment can be commenced.

When projects are conceived, there is often difficulty in coping with the variety of environmental hazards within each location and the diversity in their range and relative importance in different

locations. The social, economic, and political underpinnings of these hazards are often forgotten (or it is chosen, for whatever reason, to ignore these). As a result, many projects are too narrowly focused and give too little attention to some of the most life- and health-threatening environmental problems. Often they are rooted in too little data about what causes ill-health and premature death among poorer groups. Furthermore, the sectoral division between the institutions responsible for health care services, for water and sanitation (and other aspects of environmental health), and for occupational health, seldom lends itself to a coherent programme to identify and act on the most threatening environmental hazards.

Discovery of and understanding of the appropriate approaches to a given situation is assisted by the World Bank trend to documentation of case studies, rather than only of generic studies, noted in Section 3.2.

It can be concluded, from this review of the experience reported by international agencies, that appropriate technology and processes for the provision of engineering infrastructure (among them water and sanitation) in South Africa should consider that:

- The challenge of providing infrastructure is twofold: First, there is the "old agenda" of providing all people with adequate water supply and sanitation services. Second, there is the challenge of the "new agenda", which requires that much greater attention be paid to ensuring that use of water resources is sustainable in terms of both quality and quantity.

- The end purpose of infrastructure provision should be carefully assessed, and it be considered if the engineering investment should not be leveraged with other means to achieve the same purpose, but more effectively (or indeed that the service can thereby be increased for the same cost).

- Decentralised decision-making requires flexibility in practices and transparency in critical procedures (such as choice of engineering options, channeling of investment funds, criteria for project approval, etc.).

- Consumers should only be provided with the infrastructure they want and are willing to pay for (even if only to pay a proportion of total cost). For those who cannot pay an economic tariff, payment in kind through work can be explored.

- There is great potential for communities and even households to benefit from actively participating in the provision and maintenance of their own ongoing infrastructure. Community

management can create economic opportunities, reduce cost, improve on response time, and minimise wastage.

- Enforcement incentives for communities to manage their own infrastructure are essential, but creating the right incentives is an extremely complex task, and requires a partnership among all key actors including householders, public officials, NGOs and professionals.

- The technology selected, and its detailed design, can through self-interest reinforce these incentives.

- Community-wide processes must be complemented by a limited set of differentiated policies at household level. For example, free ridership will only be eradicated by measures that reduce the burden of paying, increase the disbenefits to householders of not paying, and increase their perceptions of the benefits of contracting to receive only as much service as that household can afford. For another example, innovation in payment methods (such as the re-scheduling of payments) may be necessary to help households who have temporary difficulty in paying.

- There are no set policy, project and programme designs through which the right incentives can be created. How actual implementation should take place would vary from community to community, with scope for tailored differentiation to appropriately cope with diverse individual and dynamic circumstances.

LIST OF INTERVIEWEES

REFERENCES

LIST OF INTERVIEWEES

The co-operation of the following interviewees in the USA is acknowledged with thanks:

At the Department of Environmental Science and Engineering, University of North Carolina, Chapel Hill, North Carolina: Richard Andrews (Professor of Environmental Policy), Professor Daniel Okun (Kenan Professor of Environmental Engineering, Emeritus), Professor Donald Lauria, Professor Dale Whittington.

At the International Partnership for Safe Water, Chapel Hill, North Carolina: Gary White (Director, Marla Smith.

At the School of Public Health, University of North Carolina, Chapel Hill, North Carolina: Dr Fran Lynn (Director: Environmental Resource Program).

At the Center for International Development of the Research Triangle Institute, Durham, North Carolina: Dr Jerry van Sant (Director), Hal Minis (Director, Urban Finance and Management Programme), May Yacoob, Dr James McCullough, Alan Wyatt.

At the Center for Environmental Analysis of the Research Triangle Institute, Durham, North Carolina: Michael Mc Carthy (Manager: Water Quality Department)

At the Water Resources Institute of the University of North Carolina, North Carolina State University, Raleigh, North Carolina: Dr David Moreau (Director)

At the World Bank, Washington DC:

(i) Members of the Water and Sanitation Division, Transportation, Water and Urban Development Department: John Briscoe (Division Chief), Harvey Garn, Arthur Bruestle, Albert Wright, M Vijay Jagannathan, Dr Alex Bakalian, Thelma Triche, Laurie Edwards, Gabrielle Watson, David Kinley, Karin Kemper, Jannik Boesen, Anaya Nance.

(ii) UNDP - World Bank Water and Sanitation Programme: John Blaxall (Manager).

(iii) Others: Dr John Roome (Co-ordinator : Infrastructure and Energy, Southern African Department), Josef Leitmann (World Bank Co-ordinator, UNDP/UNCHS/World Bank Urban Management Programme), Carl Bartone, Caroline Moser, James Hicks, Praful Patel

(Division Chief, Southern African Department), Janis Bernstein, Stephen Mayo, Gerhard Tschannerl, Abel Betancourt, H M Hassan, Evan Rotner.

Visiting at the World Bank, Washington DC: Hernando de Soto (President, Path to Property Association, Lima, Peru)

At the Urban Institute, Washington DC: Blaine Liner (Director: State Policy Center), Tom Kingsley (Director: Center for Public Finance and Housing).

At the US Agency for International Development, Washington DC: Marcia Glenn, Bob Macleod.

At the Environmental Health Project (formerly the Water and Sanitation Health Project), Arlington, Virginia: Eduardo Perez (Technical Director: Engineering and Technology), Eugene Brantly (Program Director: International Environment and Natural Resources), Robert Varley (Technical Director: Finance / Private Sector), Dan Campbell.

At PADCO Inc, Washington DC: Dr Bob Merrill (Vice President).

At Louis Berger International Inc, Washington DC: Frederic Berger (Vice President), Stephen Schwenke (Director of Planning).

At the Department of Urban Studies and Planning, Massachusetts Institute of Technology, Cambridge, Massachusetts: Professor Ralph Gakenheimer, Professor Bish Sanyal, Professor Lawrence Vale.

In the United Kingdom:

At the Development Planning Unit of University College London : Michael Safier and Michael Mattingly.

And in South Africa:

Visiting South Africa from the World Bank: John Briscoe, Josef Leitmann, Dr John Roome.

Visiting South Africa from the RTI: Hal Minis.

Visiting South Africa from the US Agency for International Development: Peter Kimm (Director:

Office of Housing and Urban Programs)

Visiting South Africa from Banes Betts Associates, Consulting Engineers, Tonbridge, Kent : Chris Banes.

Visiting South Africa from Purac Rosewater Ltd, Kidderminster, UK : Michael Martin.

At the Department of Civil Engineering, University of the Witwatersrand: Mark van Ryneveld.

At Palmer Development Group: Ian Palmer

REFERENCES

African National Congress (1994). **The reconstruction and development programme : a policy framework.** U manyano Publications, Johannesburg.

Alaerts GJ, Blair TL, Hartvelt FJA (Editors) (1991). "A strategy for Water Sector Capacity Building" **Proceedings** of a UNDP Symposium, Delft. June 1991.

Altaf MA; Jamal H; Whittington D (1992). "Willingness to pay for water in Rural Punjab, Pakistan" Water and Sanitation Report 4, UNDP-World Bank Water and Sanitation Program, Washington DC.

Arlosoroff S; Tschannerl G; Grey D; Journey W; Karp A; Langenegger O; Roche R (1987). **Community Water Supply: The handpump option.** UNDP /The World Bank, Washington DC, May 1987.

Atkinson SJ (1993). "Urban health in the Third World: a guide to the literature." **Environment and Urbanization,** London Vol 5 No 2, October 1993, pp 146 - 152.

Aziz KMA; Hoque BA; Huttly SRA; Minnatullah KM; Hasan Z; Patwary MK; Rahaman M; Cairncross S (1990). **Water Supply, Sanitation and Hygiene Education : Report of a Health Impact Study in Mirzapur, Bangladesh**, Water and Sanitation Report Series No 1, UNDP-World Bank Water and Sanitation Program, Washington DC.

Bakalian AE; Jagannathan V (1991). **Institutional aspects of the condominial sewer system.** Infrastructure and Urban Development Department, World Bank, Washington DC, August 1991.

Bakalian AE (1992). **Subdivided sewerage with localized treatment.** Infrastructure and Urban Development Department, World Bank, Washington DC, May 1992.

Bakalian AE; Wright AM; Otis RJ; de Azevedo JH (1993). "Simplified sewerage meets demands." **Water Environment and Technology,** 5 : 58, March 1993.

Bakalian A; Wright A; Otis R; Netto JdA (1994). **Simplified sewerage: Design guidelines.** Water and Sanitation Report No 7, UNDP - World Bank Water and Sanitation Program, Washington DC, May 1994.

Bamberger M; Cheema S (1990). **Case Studies of Project Sustainability : Implications for Policy and Operations from Asian Experience**, Economic Development Institute of the World Bank, Washington DC.

Banes C; Briscoe J (1991). **Infrastructure services in urban areas of South Africa : what services might be provided, how might they be financed, and how might they be delivered and maintained?** The World Bank, Washington DC. May 1991.

Bartone CR (1990). **International perspective on water resources management and wastewater reuse - appropriate technologies.** Paper presented at IAWPRC Biennial International Conference and Water Reuse Seminar, Kyoto, Japan, 29 July - 3 August 1990.

Bartone C; Bernstein J; Leitmann J; Eigen J (1994). **Toward Environmental Strategies for Cities: Policy Considerations for Urban Environmental Management in Developing Countries**. Urban Management Programe Report No. 18. UNCHS (Habitat)/The World Bank/UNDP. Washington DC, June 1994.

Biswas AK (1991). "Water resources in the 21st Century", **Water International**, Volume 16, pp 142-144.

Black M (1994). **Mega-slums: the coming sanitary crisis.** Water Aid, London, March 1994.

Blackett I (1994). **Low-cost urban sanitation in Lesotho.** Water and Sanitation Discussion Paper No 10, UNDP / World Bank Water and Sanitation Program, Washington DC, March 1994.

Bohm RA; Essenburg TJ; Fox WF (1993). "Sustainability of Potable Water Services in the Philippines", **Water Resources Research**, Vol. 29 No. 7, July 1993, pp 1955 -1963.

Braddy BA; Orenstein D; Brownstein NJ; Cook TJ (1992). "PATCH: An example of community empowerment for health." **Journal of Health Education,** Reston, Virginia. 23(3): pp170 - 182.

Bradley D; Stephens C; Harpham T; Cairncross S (1992). **A Review of Environmental Health Impacts in Developing Country Cities**, Urban Management Program Report No. 6, UNCHS (Habitat)/The World Bank/UNDP, Washington DC, August 1992.

Briscoe J (1992). **The population / environment / water-and-sanitation nexus in developing countries.** Paper presented at the Revelle Memorial Symposium, Harvard University, Cambridge, Massachusetts, October 1992.

Briscoe J (1993). "When the cup is half full: Improving water and sanitation services in the developing world." **Environment,** Vol 35 No 4, May 1993, pp 7 - 37.

Briscoe J; Garn M (1994). **Financing Agenda 21 : Freshwater : World Bank, Trasportation, Water and Urban Development Dept.** Washington DC, February 1994.

Briscoe J; VanDerslice J (1993). "All coliforms are not created equal: A comparison of the effects of water source and in-house water contamination on infantile diarrheal disease." **Water Resources Research,** Charlottesville, Virginia, Vol 29 No. 7, July 1993, pp 1983 - 1995.

Brookshire DS; Whittington D (1993). "Water Resources Issues in the Developing Countries." **Water Resources Research,** Charlottesville, Virginia, Vol 29 No 7, July 1993, pp 1883 - 1888

Cairncross S (1992). **Sanitation and water supply: Practical lessons from the decade.** Water and Sanitation Discussion Paper Series 9, UNDP - World Bank Water and Sanitation Program, Washington DC, September 1992

Cullivan D; Tippett B; Edwards DB; Rosensweig F; McCaffery J (1988). **Guidelines for institutional assessment of water and wastewater institutions**. WASH Technical Report No. 37, Water and Sanitation for Health Project, Arlington, Virginia, February 1988.

Dalton JC; Dowall DE (1991). ***Infrastructure financing and cost recovery options : international experience applicable to Thailand***. Office of Housing and Urban Programs, US Agency for Intenational Development, Washington DC, March 1991.

Davey KJ (1993). **Elements of urban management**. Urban Management Programme Report No. 11. UNCHS (Habitat)/The World Bank/UNDP. Washington DC.

Department of Water Affairs and Forestry, Government of the Republic of South Africa (1994). **White Paper: water supply and sanitation policy.** Government Printer, Cape Town. November 1994.

Edwards DB, Rosensweig F, Salt E (1993). **Designing and implementing decentralization programs in the water and sanitation sector.** WASH Technical Report No. 89, Water and Sanitation for Health Project, Arlington, Virginia, July 1993.

Elmendorf M; Buckles P (1980). **Appropriate technology for water supply and sanitation: Vol 5: Sociocultural aspects of water supply and excreta disposal.** World Bank, Washington DC, December 1980.

Environment and Urbanization (1994). "Editor's introduction [to edition on "Service provision in cities]: Basic services: new approaches, new partnerships?" London, Vol 6, No 2, October 1994, pp 3-8

Environment and Urbanization (1995). "Orangi Pilot Project." London, Vol 7 No 2, October 1995, pp 227 - 236.

Environmental Health Project, The (1994). **A challenging agenda.** (Brochure). Arlington, Virginia.

Espinosa L; Rivera OAL (1994). "UNICEF's urban basic services programme in illegal settlements in Guatemala City." **Environment and Urbanization,** Vol 6 No 2, London, October 1994.

Esrey SA; Potash JB; Roberts L; Shiff C (1990). **Health Benefits from Improvements in Water Supply and Sanitation : Survey and Analysis of the Literature on Selected Diseases**. WASH Technical Report No. 66. Water and Sanitation for Health Project, Arlington, Virginia, July 1990.

Evans P, Appleton B (1993). **Community Today : The Role of Communities in the Management of Improved Water Supply Systems**. IRC International Water and Sanitation Cenre, The Hague, June 1993.

Farvacque C; McAuslan P (1992). **Reforming urban land policies and institutions in developing countries.** Urban Management Programme Report No. 5. UNCHS (Habitat) / The World Bank / UNDP, Washington DC.

Fass SM (1993). "Water and Poverty: Implications for Water Planning." **Water Resources Research,** Charlottesville, Virginia, Vol 29 No 7, July 1993, pp 1975 - 1981

Fox WF (1994). **Strategic options for urban infrastructure management.** Urban Management Programme Report No. 17. UNCHS (Habitat) / The World Bank / UNDP, Washington DC. June 1994.

Franceys R; Cotton A (1993). **Services for the urban poor: a select bibliography.** Intermediate Technology Publications, in association with the Water, Engineering and Development Centre, Loughborough.

Franceys R; Pickford J; Reed R (1992). **A guide to the development of on-site sanitation.** World Health Organization, Geneva.

Gakenheimer R (1993). "Infrastructure shortfall as a research theme." **Changing Cities,** MIT, Cambridge, Massachusetts, Spring 1993, pp 7 & 8.

Gidman P, Blore I, Lorentzen J, Schuttenbelt P (1995). **Public-Private partnerships in urban infrastructure services.** UMP Working Paper Series 4, UNDP/UNCHS/World Bank, Washington DC, January 1995.

Goldev Corporation (1993). **The Golden Highway Development: a development initiative of Goldev Corporation.** Johannesburg.

Golladay FL (1983). **Appropriate technology for water supply and sanitation: Vol 13: Meeting the needs of the poor for water supply and waste disposal.** World Bank, Washington DC, December 1983

Grover B (1983). **Water supply and sanitation project preparation handbook: Vol 1: Guidelines.** World Bank Technical Paper No 12, World Bank, Washington DC, November 1983.

Hasan A (1990). "Community groups and non-government organizations in the urban field in Pakistan." **Environment and Urbanization**, London 2(1) pp74 - 86.

Hébert PV; Yniguez C (1986). **Sensitivity of water distribution costs to design and service standards: A Philippine case study.** Technical Note No 16, UNDP / World Bank, Washington DC.

Hogrewe W; Joyce SD; Perez EA (1993). **The unique challenges of improving peri-urban sanitation**, WASH Technical Report No. 86. Water and Sanitation for Health Project, Arlington, Virginia, July 1993.

Hoque BA; Hoque MM; Ali N; Coghlan SE (1994). "Sanitation in a poor settlement in Bangladesh: a challenge for the 1990s." **Environment and Urbanization,** London, Vol 6 No 2, October 1994, pp 79 - 85.

Humplick F; Kudat A; Madanat S (1993). **Modeling household responses to water supply : A service quality approach**, TWURD Working Paper No. 4, Urban Development Division, The World Bank, Washington DC, August 1993.

Jacobi PR (1994). "Households and environment in the city of Sao Paulo; problems, perceptions and solutions." **Environment and Urbanization,** London, Vol 6 No 2, October 1994, pp 87 - 100.

Jagannathan V (1994). **Designing water and sanitation projects for the poor: issues and lessons learned from Asia and Latin America.** The World Bank, Washington DC, June 1994 (unpublished draft) 26pp.

Jaglin S (1994). "Why mobilize town dwellers? - joint management in Ouagadougou (1983 - 1990)". **Environment and Urbanization.** London, Vol 6 No 2, October 1994, pp 111 - 132.

Jordan S; Wagner F (1993). "Meeting women's needs and priorities for water and sanitation in cities." **Environment and Urbanization,** London, Vol 5 No 2, October 1993, pp 135 - 145.

Kalbermatten JM (1991). "Water and sanitation for all; will it become reality or remain a dream?" **Water International.** International Water Resources Association, Urbana, Illinois, Vol 16 No 3, pp 121 - 126.

Kalbermatten JM; Julius DS; Gunnerson CG (1980a). **Appropriate technology for water supply and sanitation: Vol 1: Technical and economic options.** World Bank, Washington DC, December 1980.

Kalbermatten JM; Julius DS; Gunnerson CG (1980b). **Appropriate technology for water supply and sanitation: Vol 1 A : A summary of technical and economic options.** World Bank, Washington DC, December 1980.

Kalbermatten JM; Julius DS; Gunnerson CG (1980c). **Appropriate technology for water supply and sanitation: Vol 11: A sanitation field manual.** World Bank, Washington DC, December 1980.

Kalbermatten JM; Julius DS; Mara DD; Gunnerson CG (1980). **Appropriate technology for water supply and sanitation: Vol 2: A planner's guide.** World Bank, Washington DC, December 1980.

Katko TS (1991). **The development of water supply associations in Finland and its significance for developing countries**. Water and Sanitation Discussion Paper No. 8. UNDP - World Bank Water and Sanitation Program, Washington DC, November 1991.

Kehew B (1996). "USAID and PADCO help Ukraine and Russia "Get the prices right" - for water", **PADCO Perspective**, PADCO Inc, Washington DC, Jan - March 1996, p7.

Kerr C (Editor) (1989). **Community Water Development.** Intermediate Technology Publications, London.

Kerr C (Editor) (1990). **Community Health and Sanitation.** Intermediate Technology Publications, London.

Kessides C (1993a). **Institutional options for the provision of infrastructure**. World Bank Discussion Paper 212. The World Bank, Washington DC, September 1993.

Kessides C (1993b). **Contributions of Infrastructure to Economic Development : A Review of Experience and Policy Implications**, World Bank Discussion Paper No. 123, The World Bank, Washington DC, September 1993.

Khan AH (1992). **Orangi Pilot Project Programs**. 2nd addition (sic). Orangi Pilot Project - Research and Training Institute. Karachi, Pakistan.

Kinley D (1993). "Running just to stay in place: water, health and the environment." **Choices**. UNDP, New York, December 1993, pp 25 - 29.

Lauria DT (1994). **Matching supply and demand for improved sanitation using willingness to pay data**, Draft report to The World Bank, April 1994.

Listorti JA (1993) **Environmental Health Components for Water Supply, Sanitation, and Urban Projects**, Word Bank Technical Paper No. 121, The World Bank, Washington DC, June 1993.

Lovei L (1992). **An Approach to the Economic Analysis of Water Supply Projects**, Policy Research Working Paper WPS1005, The World Bank, Washington DC, October 1992.

Lovei L; Whittington D (1991). **Rent seeking in water supply**, Infrastructure and Urban Development Department, The World Bank, Washington DC, September 1991.

Mabogunge A (1991). **A new paradigm for urban development.** Proceedings of the World Bank Annual Conference on Development Economics. The World Bank. Washington DC.

McCullough JS, Moreau DH, Linton BL (1993). **Financing wastewater services in developing countries.** WASH Technical Report No. 80, Water and Sanitation for Health Project, Arlington, Virginia, October 1993.

McGarry M (1991). "Water supply and sanitation in the 1990s." **Water International.** International Water Resources Association, Urbana, Illinois, Vol 16 No 3, pp 153 - 160.

McGowan R; Hodgkin J; Kaplan P (1992). **Water supply issues in the peri-urban (informal) sector.** WASH Field Report No 355, Water and Sanitation for Health Project, Arlington, Virginia, May 1992.

McGranahan G; Mitlin D; Satterthwaite D (Editors) (1993). "Editors' Introduction: The preventable disease burden in cities." Introduction to "Health and well-being in cities" edition of **Environment and Urbanization,** London, Vol 5 No 2, October 1993, pp 3 - 7.

McPhail AA (1993). "The "Five Percent Rule" For Improved Water Service : Can Households Afford More?" **World Development**, Pergamon Press, January 1993, pp 963 - 971.

Mejia A; Tavares LC; Bakalian A; Jagannathan V (1993). **Water and sanitation services for the urban poor in Brazil: The Prosanear approach.** Transportation, Water and Urban Development Department, The World Bank, Washington DC, September 1993.

Melchior-Tellier S (1991). "Women, Water and Sanitation", **Water International**, Vol. 16, pp 161- 168.

Ministry of Urban Development, Government of India (1992). **Technical Guidelines on Twin Pit Pour Flush Latrines.** New Delhi, April 1992.

Moser C (1993). **Urban social policy and poverty reduction.** Urban Development Division working paper. The World Bank, Washington DC. October 1993.

Narayan D (1993). **Participatory Evaluation : Tools for Managing Change in water and sanitation**, World Bank Technical Paper No. 207. The World Bank, Washington DC, August 1993.

Narayan D (1995). "Designing Community Based Development", **Dissemination Notes No. 17.** World Bank Environment Department, Washington DC, 1995.

Narayan-Parker D (1989). **Pegesus - A Planning and Evaluation Framework in Partnership with people**, PROWESS/UNDP Technical Series, UNDP, New York, April 1989.

Okun DA (1991). "A water and sanitation strategy for the developing world." **Environment,** Washington DC, Vol 33 No 8, October 1991, pp 16 - 43.

Okun DA, Ernst WR (1987). **Community piped water supply systems in developing countries: A planning manual.** World Bank Technical Paper No 60, World Bank, Washington DC, April 1987.

Okun DA, Lauria DT (1991). **Capacity building for water resources management : An International Initiative for sustainable development in the 1990s**. UNDP, New York, August 1991.

Otis RJ; Mara DD (1985). **The design of small bore sewer systems.** TAG Technical Note No 14. UNDP / World Bank, Washington DC.

Parker RS (1992). "Vulnerability and resiliency: environmental degradation in major metropolitan areas of developing countries." In Kreimer A and Munasinghe M (Editors). **Environmental Management and Urban Vulnerability,** World Bank Discussion Paper No 168. The World Bank, Washington DC, May 1992, pp 107 - 153.

Paul JE; Mauskopf J (1991). **Cost-of-Illness Methodologies for Water-Related Diseases in Developing Countries**, WASH Technical Report No. 75, Water and Sanitation for Health Project, Arlington, Virginia, October 1991.

Perrett H (1983). **Social Feasibility Analysis in Low-Cost Sanitation Projects**, TAG Technical Note No. 5, The World Bank, Washington DC.

Peterson GE, The Urban Institute (1991). **Infrastructure Finance : Vol. 1 : Financing urban infrastructure in less developed countries**. Office of Housing and Urban Programs, US Agency for International Development, Washington DC, March 1991.

Peterson G, Kingsley GT, Telgarsky JP (1991). **Infrastructure Finance No. 2 : Institutional and Macroeconomic Issues**. Office of Housing and Urban Programs, US Agency for International Development, Washington DC, March 1991.

Pickford J (1990). "Water and sanitation." In **Appropriate Development for Basic Needs.** Thomas Telford, London, pp 145 - 159.

Pickford J (1991). "Training and Human Resource Development in Water Supply and Sanitation", **Water International**, International Water Resources Association, Urbana, Illinois, Vol 16.

Porter RC (1995). **The Economics of Water and Waste : A Case Study of Jakarta, Indonesia,** Environmental and Natural Resources Policy and Training Project, Madison, Wisconsin, May 1995.

Prud'homme R (1994). **On the dangers of decentralization.** Policy Research Working Paper No. 1252. Transportation, Water and Urban Development Departments, The World Bank, Washington DC, February 1994.

Rabinovitch J; Leitmann J (1993). **Environmental innovation and management in Curitiba, Brazil.** Urban Management Programme. Working paper No. 1 UNDP/UNCHS/World Bank, Washington DC.

Richard B; Triche T (1994). **Reducing regulatory barriers to Private-Sector Participation in Latin America's Water and Sanitation Services.** World Bank Water and Sanitation Division Policy Research Working Paper 1322. The World Bank, Washington DC, July 1994.

Rogers B (1989). "Water - women's work." In Kerr (Editor). **Community Water Development**. Intermediate Technology Publications, London; pp 199 - 201.

Rogerson CM (Collator) (1993). **Managing urban growth: The international experience.** Report prepared for the Development Strategy and Policy Unit of the Urban Foundation, Johannesburg. January 1993.

Rondinelli DA, Kasarda JD (1993). "Privatization of urban services and infrastructure in developing countries". In Kasarda JD and Parnell AM (Editors): **Third World Cities : Problems, Policies and Prospects**, Sage Publications, Newbury Park, California.

Rybczynski W; Polprasert C; McGarry M (1982) **Appropriate technology for water supply and sanitation: Vol 4: Low-cost technology options for sanitation: a state-of-the-art review and annotated bibliography.** World Bank, Washington DC, February 1982.

Satterthwaite D (1993). "The impact of health on urban environments." **Environment and Urbanization,** London, Vol 5 No 2, October 1993, pp 87 - 111.

Schwartz JB; Johnson RW (1991). **Maximizing the economic impact of urban water supply and sanitation investments: A Primer**, Working Paper, Center for International Development, Research Triangle Institute, Durham, North Carolina, November 1991.

Schwartz BJ; Johnson RW (1992). **Maximizing the economic impact of urban water supply and sanitation investments**, WASH Technical Report No. 82, Water and Sanitation for Health Project, Arlington, Virginia, December 1992.

Serageldin I (1994). **Water supply, sanitation, and environmental sustainability: the financing challenge.** The World Bank, Washington DC. November 1994.

Shluger E (1995) "Metropolitan development in Asia." **The Urban Age,** World Bank, Washington DC, June 1995, pp 11 & 12.

Shuval HI; Adin A; Fattal B; Rawitz E; Yekutiel P (1986). **Integrated Resource Recovery: Wastewater Irrigation in Developing Countries : Health Effects and Technical Solutions**, World Bank Technical Report No. 51, The World Bank, Washington DC, May 1986.

Singh B; Ramasubban R; Bhatia R; Briscoe J; Griffin CC; Kim C (1993). "Rural water supply in Kerala, India: How to emerge from a low-level equilibrium trap" **Water Resources Research**, Vol. 29, July 1993, pp 1931 - 1942.

Srinivasan L, Zafar R, Minnatullah KM (1994). **Community Participation : Strategies and tool : A Trainer's manual for the rural water supply and sanitation sector in Pakistan**. Ministry of Local Government and Rural Development, Government of Pakistan; UNDP-World Bank Water and Sanitation Program. January 1994.

Tamm G (1991). **Institutional framework of small community water supply systems in the USA: A review of experiences and lessons for developing countries**. Water and Sanitation Discussion Paper No. 7, UNDP-World Bank Water and Sanitation Program, August 1991.

Tayler K; Cotton A (1993). **Urban Upgrading: Options and procedures for Pakistan.** Water, Engineering and Development Centre, Loughborough, and GHK / MRM International, London, January 1993.

Triche TA (1990). **Private participation in the delivery of Guinea's water supply services.** World Bank Working Paper WPS477 Water and Sanitation. The World Bank, Washington DC, August 1990.

UNCHS (1989). **The conservation of drinking-water supplies: Techniques for low-income settlements.** UNCHS (Habitat), Nairobi.

UNCHS (HABITAT) / The World Bank / UNDP (1994). **Urban Management Programme Annual Report 1993.** Washington DC.

UNDP - World Bank Water and Sanitation Program (1992). **Improving services for the poor - a program strategy for the 1990s.** The World Bank, Washington DC, July 1992.

UNDP - World Bank Water and Sanitation Program (1995). **Annual report July 1993 - June 1994.** The World Bank, Washington DC.

US Agency for International Development (1993). **Office of Housing and Urban Programs: 1992 Annual Report,** Washington DC.

US Agency for International Development (1994a). **Office of Housing and Urban Programs: 1993 Annual Report,** Washington DC.

US Agency for International Development (1994b). "Measuring progress". **The Urban Report,** USAID Office of Urban Programs, Washington DC, April 1994, p3.

Van Ryneveld MB (1995). "Costs and affordability of water supply and sanitation provision in the urban areas of South Africa". **Water SA**, Pretoria. January 1995.

Varley R (1994). **Household credit as a financing method for peri-urban water supply and sanitation**, WASH Working Paper, task no 507, Water and Sanitation for Health Project, Arlington, Virginia, May 1994.

Velasco J; CEDATOS; Infante JA (1991). **Increasing coverage: the affordability of urban water and sewer service extension in Ecuador**, WASH Field Report No. 316, Water and Sanitation for Health Project, Arlington, Virginia, February 1991 (2 Vols).

Wakeman W (1994). **Prowwess Progress Report**, UNDP-World Bank Water and Sanitation Program, Washington DC, December 1994.

Walker J (1993). **Water and Sanitation for Health Project - Preparing for private sector participation in the provision of water supply and sanitation services.** WASH Technical Report, No. 84, Washington DC. August 1993.

Walker J, VanSant J, Brantly G, Johnson R (1992). **Private Sector Participation in Urban services in Indonesia: Water Supply, Wastewater, and Solid waste**. Staff Working Paper. August 1992. Center for International Development, Research Triangle Institute, North Carolina.

Wall K (1994). **Position paper : Geographic Information Systems for applications in developing countries, particularly urban areas.** For the Urban Institute, Washington DC. June 1994.

Wall K; Blersch W (1995). **Workable delivery systems for community engineering services : international analogies for South African residential areas.** Paper presented at Congress on Kick-starting Housing Delivery, International Executive Communications, Sandton. February 1995.

Wall K; Minis HP Jr; Goetz D (1994). **Building confidence between local government and citizens: an overview of communication approaches.** An occasional paper : Center for International Development, Research Triangle Institute, Durham, North Carolina. March 1994.

Warner DB; Laugeri L (1991). "Health for all: The legacy of the water decade." **Water International.** International Water Resources Association, Urbana, Illinois, Vol 16 No 3, pp 135 - 141.

Water and Sanitation for Health (WASH) Project (1993). **Lessons learned in water, sanitation and health: thirteen years of experience in developing countries.** Arlington, Virginia.

Water and Waste International (1993). "Incentives to improving water and sanitation services." (Interview of John Briscoe, World Bank.) Braintree (United Kingdom), April 1993, pp 28 - 36.

Watson G (1992). **Water and Sanitation in Sao Paulo, Brazil : Successful strategies for service provision in low-income communities,** Dept. of Urban Studies and Planning, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1992.

Watson G (1995). **Good Sewers Cheap : Agency-customer interactions in low-cost urban sanitation in Brazil**, Water and Sanitation Currents, UNDP-World Bank Water and Sanitation Program, Washington DC, March 1995.

Watson G, Jagannathan V (1994). **Workshop on participatory development : Participation in Water and Sanitation**, The World Bank, Washington DC, May 1994.

Watson G, Jagannathan V (1995). "Participation in the Water and Sanitation Sector", World Bank Environment Department, **Dissemination Notes No. 15**, Washington DC, June 1995.

Wegelin EA; Borgman KM (1995). "Options for municipal interventions in urban poverty alleviation". **Environment and Urbanization**, London, Vol 7 No 2. October 1995, pp 131 - 152.

Whittington D; Lauria DT; Okun DA; Mu X (1989). "Water vending activities in developing countries: A case study of Ukunda, Kenya." **Water Resources Development,** Butterworth & Co, Vol 5 No 3, September 1989, pp 158 - 168.

Whittington D; Mu X; Roche R (1990). "Calculating the Value of Time Spent Collecting Water: Some Estimates for Ukunda, Kenya", **World Development**, Pergamon Press, Vol. 18 No 2, pp 269 - 280.

Whittington D; Okorafor A; Okore A; McPhail A (1990). "Strategy for Cost Recovery in the Rural Water Sector : A case study of Nsukka District, Anambra State, Nigeria", **Water Resources Research,** Vol 26, No 9, September 1990, pp 1899 - 1913.

Whittington D; Lauria DT; Mu X (1991). "A study of water vending and willingness to pay for water in Onitsha, Nigeria", **World Development,** Pergamon Press, Vol 19, No 2/3, pp 179 - 198.

Whittington D; Smith VK; Okorafor A; Okore A; Liu JL; McPhail A (1992). "Giving Respondents Time to Think in Contingent Valuation Studies : A Developing Country Application", **Journal of Environmental Economics and Management**, Vol 22, pp 205 - 225.

Whittington D; Choe K (1992). **Economic benefits available from the provision of improved potable water supplies : A Review and Assessment of the Existing Evidence**, WASH Technical Report No. 77, Water and Sanitation for Health Project, Arlington, Virginia, December 1992.

Whittington D; Lauria DT; Wright AM; Choe K; Hughes J; Swarna V (1992). **Household demand for improved sanitation services : A case study of Kumasi, Ghana**. Water and Sanitation Report No. 3. UNDP - World Bank Water and Sanitation Program, Washington DC, May 1992.

Whittington D; Lauria DT; Wright A; Choe K; Hughes J; Swarna V (1993). "Household demand for improved sanitation services in Kumasi, Ghana: A contingent valuation study." **Water Resources Research,** Charolttesville, Virginia, 29(6), pp 1539 - 1560.

World Bank, The (1991). **Urban policy and economic development : An agenda for the 1990s.** A World Bank Policy Paper, World Bank, Washington DC. April 1991.

World Bank, The (1992a). **Staff appraisal report : Sri Lanka community water supply and sanitation project**. Energy and Infrastructure Operations Division. The World Bank, Washington DC, July 1992. (Draft).

World Bank, The (1992b). **South Africa : urban sector reconnaissance : World Bank mission:** July 29, 1992. Aide memoir. Washington DC.

World Bank, The (1993a). "Environmental priorities for development" and "Sanitation and clean water", reprint of parts of Chapters 2 and 5 of **World Development Report 1992: Development and the Environment,** Oxford University Press.

World Bank, The (1993b). **Water resource management.** A World Bank Policy Paper. World Bank, Washington DC, September 1993.

World Bank, The (1993c). **Staff appraisal report : Republic of Uganda : small towns water and sanitation project**. Infrastructure Operations Division. The World Bank, Washington DC, October 1993. (Draft.)

World Bank, The (1994). **Infrastructure policy and research activities: Abstracts of publications June 1992 - December 1993.** Transportation, Water and Urban Development Department, The World Bank, Washington DC.

Yacoob M (1994). "The importance of behaviour in developing successful practices in water supply and sanitation", **J Water SRT - Aqua**, Vol. 43, No. 1, pp 11-16.

Yacoob M, Rosensweig F (1992). **Institutionalizing community management : processes for scaling up**. WASH Technical Report No. 76, Water and Sanitation for Health Project, Arlington, Virginia, March 1992.

Yacoob M, Brantly G (1994). **Draft : Public participation in urban environmental management : A model for promoting community-based environmental management in peri-urban areas**. Water and Sanitation for Health Project, Arlington, Virginia.

Water Research Commission
PO Box 824, Pretoria, 0001, South Africa
Tel: +27 12 330 0340, Fax: +27 12 331 2565
Web: http://www.wrc.org.za