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ASIAN DEVELOPMENT BANK
Post-Evaluation Office

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SECTOR SYNTHESIS OF POST-EVALUATION FINDINGS

IN THE

WATER SUPPLY AND SANITATION SECTOR

November 1994

ABBREVIATIONS

ADTA	-	Advisory Technical Assistance
DMC	-	Developing Member Country
EIRR	-	Economic Internal Rate of Return
IES	-	Impact Evaluation Study
NRW	-	Non-Revenue Water
O&M	-	Operation and Maintenance
PEO	-	Post-Evaluation Office
PPAR	-	Project Performance Audit Report
PPTA	-	Project Preparatory Technical Assistance
SSPF	-	Sector Synthesis of Post-Evaluation Findings
TA	-	Technical Assistance
WTP	-	Willingness to Pay

NOTES

In this Report, "\$" refers to US dollars.

SS:WSS-1

I. INTRODUCTION

1. The Sector Synthesis of Post-Evaluation Findings (SSPF) in the water supply and sanitation sector provides an analysis and synthesis of issues and key factors affecting the implementation and operation of Bank-financed projects, so that the lessons learned can be used to improve the planning, design, implementation and operation of future development projects. The SSPF is based primarily on a review of the findings of post-evaluation reports prepared by the Post-Evaluation Office (PEO), including Project Performance Audit Reports (PPARs), Impact Evaluation Studies and Country Synthesis of Post-Evaluation Findings. It takes into account the information and data stored in PEO's Post-Evaluation Information System.

II. BANK OPERATIONS IN THE SECTOR

2. The principal objectives of the Bank lending operations in the water supply and sanitation sector are: (i) provision of safe drinking water and sanitation facilities to improve the health and productivity of large populations in developing member countries (DMCs); (ii) better financial management to generate internal resources; and (iii) improvement of institutional capability to efficiently operate urban and semi-urban/rural systems. Financing of water supply facilities in urban areas, provincial towns and rural areas has been done principally through the traditional mode of project lending. Sector lending modality has also been used to enable financing of groups of small systems in rural areas.

3. Bank lending to the sector (Appendix 1) started in 1968, when the loan for the Penang Water Supply Project in Malaysia was approved in the amount of \$7.2 million. Since then, 88 loans for 81 projects have been approved in an aggregate amount of \$2,298.3 million, representing about 5 per cent of total Bank lending as of 30 June 1994. Of the total lending to the sector, the largest share went to Group B countries (42 per cent), followed by Group C Countries (35 per cent) and Group A countries (23 per cent). Group B's large share is due mostly to the Philippines which also has the largest share in financing compared to other countries.

4. Bank lending to the sector has significantly increased over the past two and a half decades, although there have been shifts in country distribution. Table 1 shows that the share of Bank lending to the sector has declined for Group C countries since 1986, while that for Group A countries significantly increased. Since 1986 only four of the 28 projects approved belonged to Group C countries while the remainder was evenly distributed among Groups A and B countries. Bank lending initially concentrated mostly on relatively large cities, then on smaller towns and more recently on rural areas. In earlier years, lending mainly covered water supply services while relatively little attention was given to integration with sanitation aspects. This has recently started to change.

5. The Bank also provided technical assistance (TA) to the sector to assist in project formulation and institutional strengthening. Total TA operations in the sector amounted to about \$38.3 million. Some \$20.6 million were utilized for project preparation technical assistance (PPTA) and \$17.7 million for advisory and operational technical assistance (ADTA). Group A countries received the largest share (49 per cent) followed by Group B countries (44 per cent) and Group C countries (7 per cent). Appendix 2 shows that, among the Group A countries, Bangladesh, Pakistan and Lao PDR were the largest recipients of technical assistance.

Table 1: Loan Approvals in the Sector
(in '000 \$)

Country Group	1968-1976		1977-1985		1986-June 1994		Total	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
A	4	53,560	5	80,150	13	393,500	22	527,210
B	5	169,700	10	443,100	11	362,300	26	975,100
C	12	153,260	17	483,950	4	158,800	33	796,010
Total	21	376,520	32	1,007,200	28	914,600	81	2,298,320

III. IMPLEMENTATION EXPERIENCE AND PERFORMANCE RESULTS

6. This section examines the performance results as well as implementation experience and efficiency of post-evaluated Bank-financed projects in the sector. It assesses the extent to which Bank operations achieved their objectives in terms of expanding the capacity of water supply systems in DMCs, and in terms of reduction of non-revenue water, institutional development, financial aspects as well as economic, social and environmental impacts and sustainability. It also discusses the overall project performance and major factors affecting implementation and performance of projects. Appendix 3 provides the list of Post-Evaluation Reports prepared for the sector while the summary of post-evaluation results for the 31 post-post-evaluated projects is given in Appendix 4.

A. Post-Evaluation Coverage

7. Of the 81 projects approved by 30 June 1994, 55 have been completed and 31 have been post-evaluated. The 31 post-evaluated projects (including two sanitation projects) represent a total investment cost of \$2,144 million including Bank financing of \$612 million. These projects were approved between 1968 and 1985 and two-thirds of them have been completed in the 1980s. The country distribution of these post-evaluated projects is as follows: 17 projects in Group C countries (six each in Korea and Malaysia, three in Singapore and two in Hongkong), ten in Group B countries (three each in Thailand and Indonesia and two each in Papua New Guinea and Philippines) and four in Group A countries (one each in Lao PDR, Myanmar, Solomon Islands and Viet Nam).

B. Objectives and Scope of Post-Evaluated Projects

8. The projects post-evaluated in the sector were generally part of the long-term development program of the utilities concerned. Most projects were formulated on the basis of a feasibility study financed by the Government and/or the Bank. The water supply projects generally aimed at providing new capacity to meet future demand and improving existing facilities in the most cost-effective way in urban areas, small towns and rural areas (see Appendix 5). Other objectives were to: (i) improve operations and financial performance of water agencies; (ii) reduce the high percentages of non-revenue water; (iii) strengthen the capabilities of the executing agencies; (iv) reduce the incidence of water-borne diseases and improve firefighting capacity; and (v) extend services to low income groups. The sanitation projects were generally intended to improve public health standards by providing for an efficient sewage collection, treatment and disposal system. To achieve their objectives, the projects comprised mostly of components for the expansion of water treatment capacity, groundwater development, transmission and distribution, consultant services for detailed design and construction supervision, and technical assistance for system rehabilitation and leakage detection.

C. Attainment of Project Objectives

1. Physical Achievements

9. A total of 7.6 million cubic meters (cu m) per day of water, against the appraisal estimate of 6.8 million cu m per day were made available to 12 DMCs (see Appendix 6). Of these, about 55 per cent went to Group C countries, 43 per cent to Group B countries and only 2 per cent to Group A countries¹. Among Group C countries, Korea has the largest share of capacity expansion, followed by Malaysia. In the Group B countries, Thailand has the biggest share. A number of systems was reported to be underutilized at the time of post-evaluation, with capacity utilization ranging from 33 per cent to 80 per cent. Capacity underutilization was largely due to slower-than-expected growth in water demand. In some cases it was related to the slow rate of connection to the bulk supply system. The slower-than-expected growth in water demand was primarily due to the fact that population and water consumption growth were lower than envisaged during appraisal. It was also due in part to the unrealistically high appraisal targets for the number of users of public taps and, in some cases, declining household income combined with increases in the prices of water. The demand for piped water was also weakened in a number of cases, by the existence of alternative supplies and the perceived quality difference between piped and natural supplies. Moreover, public taps/standpipes were often not well located to maximize their use, resulting in their being not well accepted and used.

¹ This excludes the Saigon (Ho Chi Minh City) Water Distribution Project which is expected to be completed in December 1995.

2. Reduction in Non-Revenue Water

10. The objectives of most projects included reductions in the level of nonrevenue water (NRW). Appendix 7 shows that only in the case of the Singapore project was this objective achieved and to a lesser extent for the projects in Bangkok and Sabah. In most other cases results were unsatisfactory. The level of NRW generally remained high at post-evaluation. In some cases, as for the Manila Water Supply Project, Semarang Water Supply Project and Sabah Water Supply Project, the amount of NRW increased above that prevailing before the projects. NRW reached critical levels in a number of projects in all three country groups, jeopardizing their sustainability. High levels of NRW were due to several factors such as: (i) leakages; (ii) unauthorized water use and illegal connections; (iii) errors of measurement at different locations of the supply and distribution systems; and (iv) inaccurate and faulty meters.

11. Post-evaluation experience shows that reduction targets in water losses at the time of appraisal did not rely on a firm basis and systematic approach to reducing NRW. While provision was made for leakage detection and control equipment, there was no indication that the other essential inputs of manpower and organizational arrangements would be made available to effectively reduce NRW. An effective program of water loss minimization would have required (i) commitment of top management involving setting up a unit within the water enterprise exclusively to develop and implement a staged program for NRW reduction; (ii) determination of the causes of NRW; and (iii) technical assistance to install leakage control systems and implement operational improvements to reduce non-physical losses such as meter repair and replacement programs, improving efficiency in billing and accounting, and eliminating illegal connections. In addition, education at community level would have been useful to discourage water waste.

3. Institutional Development

12. Most of the projects in the sector incorporated an institutions building component to strengthen the capability of executing agencies in improving efficiency in their operations and financial management. Provisions were made for staff training, improvements in financial performance and control, establishment of commercial accounting systems and creation of new water enterprises. The ultimate goal was to enable water enterprises to generate internally adequate funds for satisfactory operation and maintenance of Project facilities, and to support development plans. Attainment of this objective, especially for projects in Group A countries, was less than satisfactory. A number of water enterprises in some of these countries at the time of post-evaluation were still beset with staffing problems. Lack of suitably qualified personnel in the technical and accounting field affected operation and maintenance of Bank-financed facilities and hindered sound financial management. Consequently, cost recovery continued to be inefficient and billing and collection remained low. Though technical assistance was provided to strengthen the capability of water enterprises, the impact was not always significant.

13. In Group B countries, with the exception of two projects, the results of institutional development efforts were generally satisfactory. Water production capacity and management capability of the Metropolitan Waterworks Authority in Thailand improved markedly as a result of the projects. The Authority has developed into a well-integrated and smoothly functioning entity from an initially weak organization beset with institutional problems stemming mainly from a lack of trained manpower, low staff morale, weak management control, water supply deficiencies and revenue shortfalls. Some improvements in the performance of the executing agencies were

achieved through the projects, although much remains to be done to strengthen performance so as to generate enough cash flow to cover cost of operations.

14. In view of the existing managerial and technical capabilities of executing agencies in implementing water supply projects in Group C countries, only limited institutional development components were provided. Where capacity improvements were necessary, they were generally addressed through loan covenants. This approach proved ineffective, as exemplified by most water supply projects in Malaysia.

4. Financial Performance

15. The financial performance of projects fell short of appraisal expectations. With the exception of the Penang Water Supply Project in Malaysia, the Mandalay Water Supply Project in Myanmar and the Water Supply Project in Singapore, the re-estimated financial internal rates of returns of all projects were lower than appraisal estimates (see Appendix 4). The lower FIRR were largely due to a combination of factors such as low water tariff, high percentage of NRW, increased operation costs and sizeable delay in implementation.

16. Water enterprises were usually government-owned and semi-autonomous public utilities. Their financial autonomy was limited by their dependence on government policies, especially those relating to tariff increases. As most governments view water enterprises as a social rather than a commercial undertaking, policies prescribed were not usually conducive to efficient operation of the water utilities. Most tariff increases were not sufficient to cover operating costs and debt service. This undermined the enterprises' financial viability. In addition, the lack of an efficient system of billing and collection further aggravated the financial condition of most utilities.

5. Economic Results

17. The economic internal rate of return (EIRR) was not calculated at the time of appraisal for any of the post-evaluated water supply projects, mostly because of complexity of benefit measurement. Economic viability was in most cases assessed under the assumption that FIRR represented a lower limit of EIRR. In other cases, economic viability was qualitatively evaluated in terms of expectations in reduction in the daily waiting time for water collection, decline in morbidity and mortality rate, and increase in labor productivity.

18. Recognizing the importance of a project's impact on economic welfare, economic analyses were carried out for the projects included in the two impact evaluation studies (IES)¹. Economic benefits were estimated in terms of a project's impact on economic welfare, taking into account consumers' willingness to pay for piped water. Results showed EIRRs higher than FIRRs, which tend to validate the assumption referred to in para. 0 above.

¹ Impact Evaluation Study (IES) of Bank Operations in the Water Supply Subsector in Bangkok and IES of Bank Operations in the Water Supply and Sanitation Sector in Malaysia

6. Socioeconomic Impact

19. Socioeconomic impacts were found to be satisfactory in the majority of the post-evaluated projects even though less people were served than expected at appraisal (see Appendix 8). Improvements in the living standard and social environment of beneficiaries were apparent in most projects. Socioeconomic surveys carried under the two impact studies indicated that water users had generally benefited from improvements in water availability, pressure and cleanliness. The results also showed that water consumption and expenditure patterns did differ between income groups.

20. In addition to providing safe and potable water, the increased availability of piped water supply and public standpipes had mostly benefited women and children who, without the projects, would have expended greater time and energy fetching water from alternative sources. Piped supplies also helped women in improving their family-owned enterprises and further enhancing their awareness of environmental sanitation and health.

21. The objective of serving those in low income groups, however, were only partly met. A number of projects reported that many people from these social categories were not connected to piped water supply because of high connection charges. In areas where the poor were served by public taps/standpipes, post-evaluation results showed that the number of people being served was less than expected as the public taps and standpipes were generally not well located to maximize their use. Project experience highlighted that more should be done to determine the actual coverage of water distribution projects and their impact on beneficiaries. An attempt should be made in projects aimed at the low income groups to ascertain that beneficiaries are being reached.

7. Environmental Impact

22. Most of the post-evaluated projects reported positive environmental impacts and indicated that projects contributed to overall health improvement. However, a number of projects reported that the rapid increase in water production had detrimental effects on the environment in a number of cases. For example, the overuse of groundwater in some areas in Bangkok caused ground subsidence, directly damaging buildings and infrastructure and increasing the severity of flooding in Bangkok metropolitan areas. The increased use of water made possible by project facilities increased the production of wastewater which in many cases aggravated waterlogging in low-lying areas because drainage capacity was limited. The situation was largely due to a lack of linkage between the projects and specific action plans for wastewater collection and disposal.

D. Implementation Efficiency

23. Project performance is determined, among other factors, by the efficiency of implementation arrangements. Factors that impinge on the implementation process include changes in scope, implementation delays and cost variations.

1. Changes in Project Scope

24. Most of the project facilities were constructed as planned, though some changes were made to better adapt the systems to actual conditions. In some cases, major components were added, enlarged or modified; in others, they were scaled down or deleted. Though the changes in scope and design made during implementation generally did not affect project objectives, they contributed to implementation delays, which in turn resulted in cost overruns. Experience shows that while changes made generally improved project performance, many would not have occurred if the loans had been made at a later stage after final design had become available.

2. Implementation Delay

25. All post-evaluated projects experienced implementation delays. The average implementation period was 6.3 years, and the average delay was 2.5 years. Delays stemmed from significant changes in design and scope, right-of-way constraints, procurement problems, delay in recruitment of consultants, adverse soil conditions, poor performance of the contractors and unrealistic implementation schedules. Unfamiliarity of executing agencies with the Bank's policies and procedures, inadequate provision of local funds and changes in Government policies also contributed to delays. The longest delays occurred in Group A countries, averaging about 3.8 years (or 120 per cent longer than the original schedule) compared with 2.8 years (or 73 per cent) for Group B countries and 2.1 years (65 per cent) for Group C countries (see Appendix 9). Significant changes in scope combined with weaknesses of the executing agencies contributed significantly to the delays of projects belonging to Group A countries.

3. Cost Variation

26. Seventy-seven per cent of post-evaluated projects (24 projects) in the sector were completed with substantial cost overruns, with 16 projects recording cost overruns greater than 25 per cent. Most projects were implemented during the seventies and thus bore the effects of high inflation following the 1973 oil crisis which, in many cases, were aggravated by implementation delays resulting from significant changes in scope. Group A countries recorded the highest average cost overrun of 120 per cent, followed by Group C countries (51 per cent) and Group B countries (39 per cent). Cost underruns averaging 27 per cent, shown in see Appendix 10, were experienced in 7 projects. Underruns resulted mainly from reduction in project scope, lower-than-expected cost of equipment and materials, devaluation of the local currency against the US dollar, and non-utilization of price and physical contingencies.

E. Performance Results

27. The Bank's assistance to the sector helped expand the capacity of water supply systems in 12 DMCs to meet the existing and future requirements of both the urban and rural population. There were health benefits from a number of water supply and sanitation projects both in direct terms of avoided medical expenses and in indirect productivity gains due to reduced morbidity. Though generally achieving expected system capacities, projects fell well short of appraisal expectations in terms of implementation period, quantity of water produced and sold, reduction in NRW, number of connections and improvement in the performance of water utilities. In most cases, they benefited the higher income groups more than poorer people as water prices were subsidized and connection charges were relatively high. In addition, the higher income groups were better located with respect to the piped water system. Shortfalls in water supply performance were greater in the semi-urban and rural districts than in urban areas.

28. A variety of factors (both internal and external) affected project performance. They included the appropriateness of project design, implementation efficiency, operational sustainability, the capability of the executing agencies, and exogenous factors. A number of projects did not fully meet their intended objectives for the following reasons: (i) lack of proper balancing among financial, economic and social objectives in the design and operation of the water systems; (ii) inadequate understanding of factors affecting demand which led to unrealistic demand estimates resulting to excess system capacity; (iii) failure to reduce the rate of NRW which adversely affected the financial performance of water utilities; (iv) managerial/institutional shortcomings emanating from a lack of autonomy of the water utilities to plan and conduct their own financial concerns; and (v) inappropriate accounting standards and price setting methods. The policy framework, in some cases, was also not conducive to efficient operation of projects.

29. Overall, 19 of the 31 post-evaluated projects were considered generally successful and 12 were rated as partly successful. None of the projects were rated as unsuccessful. Group C countries received the highest "generally successful" rating (77 per cent), followed by Group B countries (50 per cent) and Group A countries (25 per cent). In terms of investment costs, 62 per cent of post-evaluated projects were generally successful and 38 per cent partly successful, while in terms of loan amount disbursed, the "generally successful" rating was 67 per cent and the partly successful one, 33 per cent (see Appendix 11).

IV. ISSUES AND LESSONS LEARNED

30. This sections summarizes the critical sectoral issues and major lessons learned from post-evaluation experience. A list of these issues is given in Appendix 12.

A. Key Issues

31. On the basis of the findings and results of PPARs and impact evaluation studies undertaken in the water supply sector, major issues for consideration include: project design, institutional development of water utilities, water pricing, and economic evaluation.

1. Project Design

32. One critical issue is matching technology or design with the resource base of target communities. The design, construction and operation of water utilities should be conceived and carried out in line with the financial, economic and social objectives of projects. This could be achieved if the major factors affecting both the supply and the demand for piped water were adequately examined.

33. One key factor affecting supply is the production and distribution technology employed. In designing urban water supply projects, the emphasis should be on major systems components -- such as dams and other source works, transmission systems, treatment plants and primary distribution facilities -- and on secondary distribution systems which deliver water to consumers. With the increasing availability of reliable technical and socioeconomic data, and the widespread availability of computer-based techniques of analysis, the financial and social impact of system overdesign on small low-income communities can be avoided. The importance of ensuring that the costs of water supply systems lie within the capacity of the water district communities to pay was reaffirmed by experience from post-evaluated projects.

2. Institutional Development of Water Utilities

34. For water supply utilities to become independent and financially sustainable enterprises, it is necessary that (i) water utilities be manned by qualified staff; (ii) water charges be increased to financially viable levels; (iii) management information and accounting systems including billing and collection be improved; (iv) degree of real autonomy and accountability be established; and (v) operation and maintenance (O&M) be improved and NRW be reduced to acceptable levels. The Bank recognized the importance of these requirements. Provisions were made for staff training, improvements in financial performance and control, establishment of commercial accounting systems, creation of new water enterprises and reduction of NRW. Despite their positive results in some cases, these institutional development efforts proved to be inadequate to make a significant impact on water utilities. Staffing problems are still endemic, particularly in small water utilities; billing and collection procedures are often not efficient; maintenance of physical infrastructure is inadequate; and basic management information systems are still generally non-existent in a number of water utilities.

35. The less-than satisfactory results of institutional development efforts provide reasons for the Bank to look for more effective ways or measures of improving water supply utilities. Measures may include wider application of commercial management principles, broader use of competition, and increased involvement of users and other stakeholders where commercial and competitive action is constrained. The first measure would encourage management of water supply and sanitation infrastructure more like a business than a bureaucracy. The provision of infrastructure should preferably be conceived and run as a service industry that responds to consumers demand.

36. Introducing competition would give consumers choices for better meeting their demands and put pressure on suppliers to be efficient. Finally, giving users and other stakeholders a strong voice and real responsibility (particularly where market discipline is insufficient to ensure accountability to users and other affected groups) should improve general efficiency and meeting of needs and demand.

37. Experience has shown that one of the factors that influenced the success of water utilities was the degree of autonomy which the utility had in planning and conducting its operations. Hence, efforts to improve performance of water utilities would involve giving water utilities managerial and financial autonomy while also holding them accountable for their performance. This would mean that government should refrain from intervening in management while providing an environment conducive to efficient operation.

38. Components in the water supply and sanitation sector that can be competitively provided should be identified for bidding by private suppliers and contractors. This approach is being successfully implemented in Malaysia where a number of water utilities are pursuing private involvement in the maintenance, operation and development of water sources, supply and distribution facilities. Recognizing this trend, the Bank should encourage governments and water supply utilities to pursue corporatization eventually leading to privatization where there would be clear benefits from the process.

3. Water Pricing

39. The crux to financial viability of water utilities is cost recovery from users. This can be achieved by combining tariff levels reflecting full costs with efficient billing and collection procedures. Tariffs and recovery rates continue to remain critical issues in nearly all DMCs, notwithstanding the evidence that, in most cases, people have been willing to pay for water supply above existing tariff levels and that tariffs can be structured to appropriately blend equity and efficiency objectives. The difficulty has been that there is a general political resistance to tariff increases and to maintain tariff levels in real terms.

40. In determining the appropriate tariff level and structure, it is important that a distinction be made between the minimum level of financial performance necessary for the continued efficient operation of the enterprise and the adjustments that need to be made to reflect wider economic and social objectives. In this regard, the tariff structure should be sufficient to cover O&M costs, enable debt servicing and support development plans while, at the same time and where appropriate, provide low lifeline tariffs for low consumption and a penalty rate for high consumption.

41. Because of their vital importance for the sector, all available avenues should be examined to assist DMCs in setting, adopting and enforcing appropriate tariff levels along with efficient billing and collection systems. Experience shows that these cannot be achieved solely through loan covenants. Political hesitancy to regularly raising tariffs could possibly be overcome through a combination of (i) continued policy dialogue supported by progressive privatization congruent with market values of water, and (ii) direct Bank assistance aimed at supporting consumers education making them aware of the value of water, the costs of treatment and supply, and of the need for both conservation and further capacity expansion of the supply system. One avenue to improving consumers' awareness of these issues may be to strengthen public relations units within utilities and use appropriate media forms to that end.

4. Economic Evaluation of Water Supply Projects

42. Because of the complexity of benefit measurement, the common practice in the past was to approximate the FIRR of water supply projects as the lower limit of the EIRR. The rationale for this was that since the revenues considered in the FIRR did not include health related and other intangible benefits associated with water supply and sanitation projects, the EIRR could be assumed to be higher. Such estimation of the EIRR, however, is inappropriate because the benefits (represented by the willingness to pay (WTP) for the water service) are not synonymous with monetary revenues of the utility (water charges). In most cases, it can considerably underestimate actual economic returns and distort perceptions on the sector's worth, leading water supply to being distributed at low charge. Also, such estimation is not comparable to estimated EIRRs for projects in other sectors of the economy, making inter-sectoral allocation of investments less rational and less favorable for the sector.

43. The Bank has recognized the importance of conducting economic analysis of water supply projects as water is becoming scarce and many sectors are competing for its use. A number of techniques for estimating economic returns are being developed based on the relationship between consumers' WTP and water use represented by the demand curve. It is noted though that estimating WTP often requires complex, time consuming and costly surveys by trained personnel for uncertain results representing perceptions at a specific point in time. It would be preferable that the Bank adopt an approach to project cost-benefit analysis in the sector which is expedient, cost effective and practical.

B. Major Lessons Learned

44. The traditional least-cost approach to planning of water supply projects is inadequate to achieve sustainable resource use efficiency. What is required is an approach that integrates both supply- and demand-side concerns and accounts for nonmarket costs and benefits. A bias against sound environmental management has thus far been encouraged by the difficulty of assessing the monetary values of environmental goods and services. The challenge is to devise a more comprehensive approach to cost-benefit analysis in which rigorous attention is paid to nonmonetary consequences of investments. Currently, this is actively being considered by the Bank.

45. The extent to which benefits from water supply are likely to be sustained will depend upon greater recognition of the role that prices can play in managing water demand, to expand supply and conserve the environment. Improvements in tariff levels and structures should mainly be concerned with economic efficiency and directed at making tariffs charged to different consumers reflect more closely the long-run economic cost of supply. This should be done in a manner consistent with social and other objectives, such as meeting at least the minimum needs for potable water of the lower-income groups.

46. Sustainability is also undermined by the excessive loss of water in transmission and distribution systems. Experience suggests that technical remedies are necessary but not sufficient to solve the problems of non-revenue water which are usually also linked to broader managerial, organizational, and social issues that need to be appropriately dealt with as well. High economic returns will be generated by investments in the reduction of non-revenue water as it will simultaneously increase sales, cut production costs and save waste. In actuality, sustainable

development and management of water resources need to focus on reducing water loss and wastage rather than investing in supply capacity expansion and new distribution systems.

47. Experience of post-evaluated projects further demonstrates the importance of local knowledge in the design and implementation process. Consideration of alternative low-cost water sources and the economic advantages of developing water systems conjointly for several towns based on a common water source would yield significant benefits to the sector. One example of the necessity of considering local knowledge in the project preparation process is the inadequate understanding of the real demand for piped water and the related price responsiveness of consumers. Rigorous socioeconomic research is required to provide a better understanding of the market for piped water and the response of consumers to different service standards, tariff levels and pricing structures.

48. Post-evaluation experience shows that fostering application of broad reform instruments such as commercial management, competition and involvement of stakeholders would promote efficient and responsive delivery of water supply services in most countries and circumstances. DMCs need to be encouraged to conceive and manage water supply infrastructure like a business or a service industry that responds to customer demand. Introduction of enhanced competition in the water supply sector would give consumers choices for better meeting their demands and put pressure on suppliers to be efficient and accountable to users. Finally, there is a need for giving users and stakeholders a strong voice and real responsibility (particularly in situations where market discipline is insufficient to ensure accountability to water consumers and other affected groups) in the planning and management of water supply systems.

49. With corporatization and privatization, it will become critically important to determine the appropriate form of price and quality regulation for water services. Particular attention should be paid at fostering and encouraging independence of regulating authorities from both the political and the process of structural reform. The Bank may have an important role to play in that regard.

50. With increasing concentration of urban population and economic development, assistance in water supply and sanitation is becoming increasingly necessary in a number of DMCs. The Bank needs to evolve special approaches to adequately cope with this rapidly changing situation.