ADB

WATER for ALL

Asia-Pacific Water Forum

Access to Drinking Water and Sanitation in Asia: Indicators and Implications

Asian Water Development Outlook 2007

Discussion Paper

Access to Drinking Water and Sanitation in Asia: Indicators and Implications

Bhanoji Rao

Summary

Aiming for inclusive growth in Asia will make little practical sense unless targets are set and policies, programs, and projects are articulated to achieve universal water and sanitation access. Composite indicators like the Human Development Index are of great help in pinpointing the areas where action is needed.

An Index of Drinking Water Adequacy (IDWA) is proposed in this paper, which is simple to interpret. Its components indicate directions for policy, program, and project actions. However, there is a need to re-examine how water and sanitation access data are collected and how a fair degree of accuracy and cross country comparability can be assured.

At present, half way through the Millennium Development Goals timeframe, fine-tuning the goals on water and sanitation may be considered by developing member countries of the Asian Development Bank, with a view to achieving universal house connections by an appropriate date.

Introduction

As Asia's growth momentum continues, policy makers in all the emerging economies have become fully aware of the need to focus attention on ensuring the inclusion of all people, especially the vulnerable sections, in sharing the benefits of rapid economic growth.

Inclusive growth has two dimensions: who are to be included and what are to be included. The answer to the first is well known: the poor and less endowed must be included in generating economic growth as well as in sharing its benefits. Such an outcome results from the right development strategies that promote full employment as well as a high rate of economic growth. There will still be some who could be left behind due to lack of right skills and those who are outside of the labor force for one reason or the other and who are unable on their own to achieve a decent living standard. They too need to enjoy a fair share of the fruits of high rates of growth, and most policies aimed at inclusive growth take account of these concerns.

In regard to what to include in inclusive growth, developmental experience of the past several decades has led to a host of refinements. It has been recognized that development policy targets at national and global levels are no longer limited to articulating desired growth rates, and targeted reductions in poverty. This recognition at the global level has led to the articulation of the Millennium Development Goals (MDGs), which range from reducing poverty and hunger to improv-

…indices are useful in focusing attention…They have considerable political appeal. They have a stronger impact on the mind and draw public attention more powerfully than a long list of many indicators, combined with a qualitative discussion. They are eye-catching.[1]

ing education, health and the environment. The eight goals that have been set out under the MDGs[2] include within them every possible component that should find a place in inclusive growth. Of particular significance to this paper is Goal 7, which has the subgoals of access to water and sanitation, stated as: "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation."

Achievement of relatively rapid overall economic growth (such as, for instance, the high rates witnessed in the People's Republic of China and India in the recent past) can hardly be equated to uprooting acute poverty and disease. In fact, even if rapid economic growth were to lead to reduction in poverty based on a dollar a day or a specific national poverty line, it still may not mean adequate access to safe drinking water and sanitation.[3]

This paper provides, in relation to developing member countries[4] (DMCs) of the Asian Development Bank (ADB), an evaluation of the well known Water Poverty Index and proposes an Index of Drinking Water Adequacy (IDWA). The case for fine-tuning the water and sanitation MDG in terms of house connections is provided and a critical review of presently available and globally publicized data on access to water and sanitation is presented. Finally, a list of action points is given.

Water Poverty Index: An Evaluation

Composite Indicators

Thanks to the successful history and the wide reach of the Human Development Index (HDI), recognition of the utility of composite indicators has been relatively firmly established. HDI, which combines one indicator each of health and education with per capita income helps in seeing deficiencies in the three important dimensions of human development. Inspired by the success of HDI and allied composite indicators, several attempts have been made to compile similar composite indicators in various spheres of economic and social development. In regard to water, a notable attempt has been the construction of the Water Poverty Index (WPI).

WPI Main Components

The concept and methodology of WPI has been amply explained in Lawrence et al (2002).[5] WPI combines measures of water availability and access with measures of people's capacity to access water on a sustained basis, the use of water, and environmental factors that affect water quality and ecology. The five components of WPI are briefly explained below.

- ***Availability*** of water is indicated by surface and groundwater resources that can be drawn upon by the residents of a nation.
- ***Access*** includes both safe water for drinking and cooking, and water for irrigating crops or for non-agricultural use.
- ***Capacity*** is taken as the possession of purchasing power to obtain improved water. Additionally, in the construction of WPI, education and health are considered because they "interact with income and indicate a capacity to lobby for and manage a water supply" (Lawrence et al, endnote 5, p. 2).
- ***Use*** reflects domestic, agricultural, and non-agricultural uses.
- ***Environmental factors*** considered are those likely to have an impact on regulation and affect capacity.

Measurements, Evaluation, and Implications

The objective of looking at each component and subcomponent of the WPI is two-fold: to see how the various components are integral to what is being measured (water poverty), and to select those that are critical to an index relating to water with special reference to inclusive growth.

Availability

Both external and internal inflows (resources) are considered. The volumes are measured on a per capita basis and converted to a log scale.[6] Weight for the two sets of inflows is half and half. The World Bank in its World Development Indicators (WDI), 2006 (page 148) has taken the following view in regard to external inflows: "River flows from other countries are not included because of data availability." The inflows data in WDI, especially those that include use-wise distribution of withdrawals, were all given for a range of years, namely 1987–2002. Thus, if the World Bank thought that data were not available even within this broad time range, the matter must be taken seriously. The implication is that it is best to limit the measurement of availability to internal resources and let other aspects take account of the lack of internal resources.

Access

The indicator of access has three components: percentage of population with access to 'safe' water, percentage of population with access to sanitation, and an index that relates irrigated land as a proportion of arable land to internal water resources. "This is calculated by taking the percentage of irrigated land relative to the internal water resource index and then calculating the index of the result. The idea behind this method of calculation is that countries with a high proportion of irrigated land relative to low internal available water resources are rated more highly than countries with a high proportion of irrigated land relatively to high available internal water resources." (WDI 2006, page 6).

It is important to look at access for water and not mix it up with sanitation, especially because only one sanitation indicator is available.[7] As for water availability for irrigation, it is important, but a relatively more direct indicator could be considered. Water access indicators and the percentage of internal resources used for irrigation could be considered for measuring access, if access is to take account of water for personal and agricultural uses. In general, water for personal use (drinking water) should be distinguished from other uses. In particular, water used for agriculture may be better suited for composite indicators, such as an index of food security.

Capacity

The capacity measure is based on four components. The most straightforward and easily justified component is the index of purchasing power denoted by log gross domestic product (GDP) per capita (in purchasing power parity (PPP) terms). The other three indicators are under-5 mortality rate (per 1,000 live births), an index of education taken from the Human Development Report 2001, and the Gini coefficient, which denotes the extent of inequality in income/expenditure. Where the Gini is not available, measurement is based on the first three components. As is well known, the HDI captures precisely the indicators of income, life expectancy, and education. Thus, one can use HDI itself as a measure of capacity.

Our judgment is that it is enough to use income as the capacity indicator. As for education, the link between education and capacity is circumspect. Regarding health, water—the elixir of life—is an input and health could be considered as output. Hence, the measurement of capacity could be simply limited to income. As for Gini, use of household income in some cases and household expenditure in others, variations in household size across income and expenditure groups, differences in the years to which different household surveys refer, accuracy of income/expenditure measurement, etc., severely limit the comparability of the indicator across countries.

We conclude that capacity to buy water is well reflected by per capita income. That alone is good enough as the case of Singapore illustrates. This country has the buying power to obtain some water from neighboring Malaysia. In addition, Singapore's buying power has been responsible for experiments with obtaining water from desalination and recycling.[8]

Use

Use is measured on the basis of three components: domestic water use per capita (cubic meters per person per year), industrial water use per capita, and agricultural water use per capita. Taking 50 liters per person per day as a reasonable target for developing countries, an index is developed taking countries below and above the norm. The typical nation with consumption of 50 liters has an index value of 1. Countries below the norm have an index that is proportionately reduced. For countries above the minimum, the index decreases as consumption exceeds 50 by higher margins. This procedure is used in order not to 'reward' excessive use of water. Use, however, is not limited to personal use, but also encompasses industrial and agricultural uses (in addition to irrigation water covered already).

For industrial and agricultural water use, instead of taking per capita consumption, the proportion of GDP generated by the sector is divided by the proportion of water used by the sector. The authors of WPI state, quite rightly, that the index for each sector reflects the efficiency of water use.

However, if the intention is to measure water poverty or inadequacy for personal use, there is little justification to include other uses, which should go into other more appropriate composite indicators. Poverty/inadequacy in respect of water must be clearly in terms of which use is being considered. First, it could be in terms of individuals (or families). Here a norm has to be used, and instead of going for diverse measurement strategies for below norm and above norm, the same approach as in the case of per capita GDP could be considered, which is to take the indicators based on conversion of raw data to a log scale. Second, there is the dimension of inadequacy for agriculture and industry. These components should go into such indicators as agricultural sustainability and industrial investment climate.

Environmental Factors

The index of environment is an average of five components, all of which are based on data used for the Environmental Sustainability Index (ESI).[9] The five are: an index of water quality (based on dissolved oxygen concentration, phosphorus concentration, suspended solids, and electrical conductivity); an index of water stress (based on fertilizer consumption per hectare of arable land, pesticide use per hectare of crop land, industrial organic pollutants per available freshwater, and the percentage of the country's territory under severe water stress); index of regulation and management capacity (based on indices of environmental regulatory stringency, environmental regulatory innovation, percentage of land area under protected status, and the number of environmental impact assessment guidelines for different sectors of the economy); index of informational capacity (based on measures of availability of sustainable development information at the national level, environmental strategies and action plans, and the percentage of ESI variables missing from public global data sets); and an index of biodiversity (based on the percentage of threatened mammals and birds).

Regarding these components, water poverty or inadequacy is intimately linked to water quality and there can be no two views on that. Other environmental measures are all important for ESI but perhaps not water for personal use per se. Water quality indicators alone should be considered for measurement of water poverty or inadequacy. After all, managerial and system efficiency, etc., are ultimately to provide adequate and good quality water. Quantum indices having been covered earlier, an index of quality should also be included. Yet, in regard to Asia, the poor extent of data availability (for just about a dozen economies) precludes the use of the water quality indicators.

Summary of WPI Components

Box 1 gives a summary of components and subcomponents of the WPI, with the number of indicators in each component indicated in square brackets. There are 12 indicators in all for resources, access, capacity and use, in sharp contrast to the 15 for environment. It is not proper to say which of the indicators are more or less important unless the purpose and focus are clearly marked.

There is considerable scope to refine the inputs of WPI and redesign the output in the form of a composite index that is relatively more closely linked to access to drinking water, one of the most vital components in delivery of inclusive growth. Also, in the spirit of HDI, it is necessary to limit the number of components in a way that would tell the policy maker why a nation's composite index is relatively low and what component needs priority attention.

Box 1: The 27 Indicators in the Water Poverty Index

Resources

Per capita external and internal inflows [2]

Access

Percentage of population with access to 'safe' water, percentage of population with access to sanitation, and an index that relates irrigated land as a proportion of arable land to internal water resources [3]

Capacity

An index of purchasing power, under-5 mortality rate, an index of education, and the Gini coefficient [4]

Use

Domestic water use per capita, industrial water use per capita, and agricultural water use per capita [3]

Environment

Water quality (four indicators), water stress (four), regulation and management (four), informational capacity (three), and biodiversity (one) [15]

Index of Drinking Water Adequacy for Asia[10]

IDWA Background

The usual access indicators suggest that access to water in the 44 DMCs has improved significantly over the past decade and a half.[11] In terms of such aggregate access indicators, one can reasonably hope for close to universal access to water in less than a decade for most people covered by the 44 economies. The question remains, however, that what we seek is not some form of coverage and some access,[12] but quantitatively and qualitatively good access with coverage that is secure. The proposed IDWA is a first step to fill the gap.

Of the 44 DMCs, the following economies are not covered due to a paucity of adequate information from national and global sources: Afghanistan; Armenia; Bhutan; Brunei Darussalam; Hong Kong, China; Singapore; Taipei, China; and several of the island and other economies with less than a million people. The IDWA is computed for 23 DMCs, accounting for 3.4 billion people (2004 estimate), which is close to 99% of the total population of all 44 economies.

IDWA Components

Resources

Estimates of renewable internal fresh water resources[13] per capita are from WDI 2006, which refer to 2004. The per capita figures are converted to a log scale. The resulting values are converted to an index as follows. Taking the resource per capita, R_j for country j, we have

Indicator for country 'j'=
$[(R_j - R_{min}) / (R_{max} - R_{min})] \times 100$

The maximum recorded per capita internal resource is that of Papua New Guinea (PNG) at 138,775 cubic meters (m^3) in 2004. The PNG figure is the maximum not only for Asia but also for all countries covered in WDI. The minimum possible resource per head is taken at a nominal 1 m^3, which in log form is zero. Thus, the index of resource availability is the log of a given nation's resource per capita divided by log (138,775). In the sample of 23 countries, while PNG had the maximum index value of 100, Pakistan had the minimum of 49.

Access

This refers to some access and is essentially what is widely publicized under the MDG (see endnote 12). We use the latest (2004) estimates of access, measured as percent of population with access to a sustainable 'improved' water source. In this case, the maximum possible access is availability of safe water for 100% of the population. The minimum here cannot be zero, but could be some other low number consistent with the definition of "sustainable improved" water source. In the MDG database, among 225 economies, Ethiopia had the lowest access rate of 22% in 2004, while countries with 100% access ranged from Andorra to Malaysia[14] and the USA. The computed index for the DMCs shows PNG with the minimum value of 22 and Malaysia with the maximum of 100.

Capacity to Buy Water

Per capita GDP in PPP US dollars is used as a measure of a nation's and/or its people's capacity to purchase water. Among the 23 economies, estimates are not available for Myanmar and Turkmenistan. In both cases, estimates are derived by comparing a nearby economy on the scale of power consumption per head. Thus, comparing Bangladesh and Myanmar, the per capita GDP of the latter is obtained. In the case of Turkmenistan, the comparison was with Uzbekistan. As for the minimum-maximum estimates, the figure of US$630 of Malawi was used as the minimum and US$20,530 of the Republic of Korea was the maximum.[15]

Use

The most challenging task has been computation of per capita water consumption by the domestic sector, which, in this paper, is referred to as "drinking water", and for which a set of ready made numbers is unavailable from any of the international databases. Thus, three alternative sets were computed and averaged for the final estimate.

The first set is based on the WDI 2006 data for each country on annual freshwater withdrawal[16] in billion m^3 for "1987–2002," which refers to some year within the range, depending on data availability. To this aggregate we apply the average population based on the country's population in 1990 and 2000. The per capita withdrawal is multiplied by the proportion used for domestic purposes, estimates for which are also available in WDI, and which refer to the same range of years. The resulting annual figure is converted into liters per capita per day (LPCD).

The second and third set of estimates are based on the data reported by World Resources Institute[17] for some year in the range 1987–1995, and for the year 2000, respectively. In both cases, the starting point is the annual withdrawal per capita. Applying the percentage of water used for domestic purposes and converting the annual figure to daily average, estimates of consumption per capita per day are obtained. Estimates for 2000 were available only for 10 countries. Thus, the final average per capita consumption is based on three observations for each of 10 economies and two for each of the remaining 13 economies.

For obtaining the index of use based on the estimate of per capita consumption, we require minimum and maximum norms. The minimum is taken as 70 LPCD as prescribed by the Indian Government (Box 2). For the maximum, although there are countries within our sample that have recorded consumption levels as high as 393 (Republic of Korea), we base our norm on the laudable experience of Singapore, where water conservation is combined with guaranteed continuous supply of water that can be safely consumed straight from the tap. The 1995–2002 average of per capita domestic consumption in Singapore was found to be 167 LPCD. Using the minimum and maximum norms, the index of use was computed for the 23 economies.

The computed index is higher than 100 in a few countries due to high levels of consumption. In such cases the value is taken as 100, thus ignoring what may well be some wasteful consumption. There are cases where the index is negative, simply because the numerator is negative, that is, the particular country's per capita consumption is less than the norm of 70 LPCD. These negative index values are left untouched, because they speak eloquently about water inadequacy. (Note: Although the base data are not close to the year 2004, it is our hope that the inter-country relativities are reflected adequately and are valid for 2004, the year for which most other component indicators refer.)

An Indirect Measure of Quality of Drinking Water

We noted earlier the paucity of good data on water quality for many Asian countries, and use instead one major disease that reflects the water quality: diarrhea. Data on diarrheal deaths per 100,000 people for the year 2000 are considered. World Health Organization data indicate a maximum death rate of close to 100 in Lao PDR and a minimum of 0.5 in the Republic of Korea, with a wider band of variation in the world at large.[18] The index is computed by taking the difference between 100 and the country value, as an indirect measure of water quality.[19]

Box 2: Water Norms and Priorities in India

Norms for Drinking Water

Under the Indian Government's Accelerated Urban Water Supply Programme taken up in the Eighth Five Year Plan (1992–1997), the norm was set at 70 LPCD. Other norms were given as follows: with sewerage: 125 LPCD; without sewerage: 70 LPCD; and with spot sources and public stand posts: 40 LPCD.

Prioritization

According to the National Water Policy 2002 of the Government of India, issued by the Ministry of Water Resources, the following is the priority order for using water resources.

- Drinking water
- Irrigation
- Hydropower
- Ecology
- Agro-industries and nonagricultural industries
- Navigation and other uses.

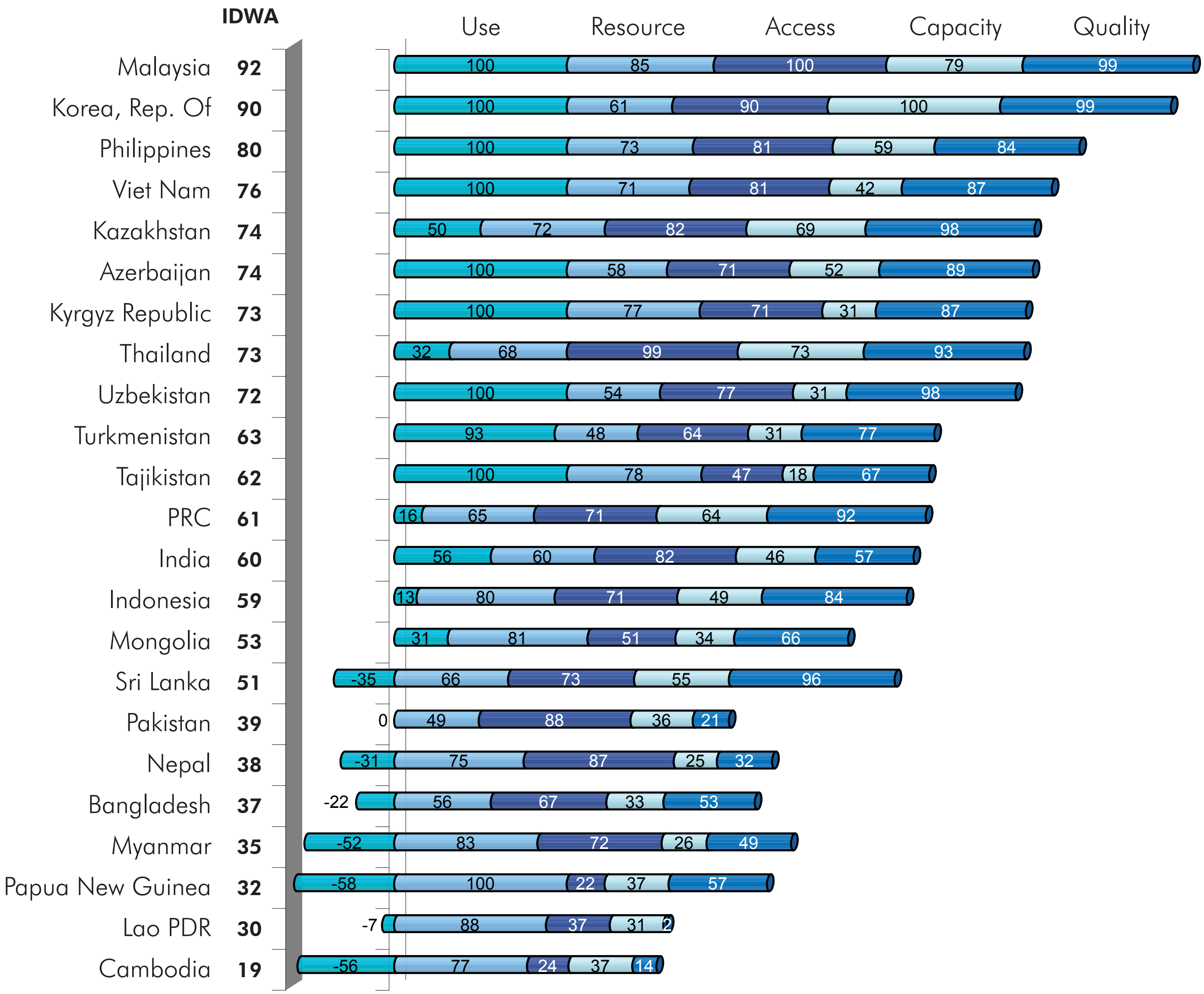
IDWA Composite Index

For each of the 23 economies, the index values for resource, access, capacity, use, and quality are averaged to obtain IDWA values by country. Figure 1 shows the five component indexes as well as the IDWA values,[20] arranged in descending order.

Messages from and Uses of IDWA

The index provides the relative position of the different countries in a more comprehensive fashion than do simple access indicators. In fact, each component could trigger a message, depending on an economy's particular need. Here is a simple set of messages coming from each component:

Figure 1: IDWA Values for Selected Asian Economies



Note: Background tables are given in the Statistical Appendix.

- Harness resources already available. If paucity of resources is the problem, galvanize other initiatives to overcome it.
- Improve access by finding the bottlenecks.
- Check if the problem is one of lack of capacity among the poor.
- Overcome low levels of use and control waste.
- Fight the quality problem by ensuring supply of really safe water.

As for use, IDWA can assist the development policy, program, and project community as a tool for assessment, monitoring, and benchmarking. The comparative numbers in Figure 1 could become a potent instrument for national leaders and planners as well as multilateral development finance institutions to make the case for investing in drinking water in countries that must raise their stature on the index to levels close to 100.

IDWA also helps in targeting one or the other component in a country's endeavor to move up. For instance, PNG has the resource but does not have the rest of the wherewithal to supply water. Malaysia has an edge over the Republic of Korea, because of the former's high degree of resources and access, while the latter has a high level of capacity that soon must be converted into higher access, even in the absence of adequate water resources.

In any exercise on development indicators, it is only natural that policy makers as well as the general public are keen to have some comparative assessment of the two most populous nations of Asia and the world, PRC and India. The comparative profile on IDWA and components for the two countries (in Figure 1) show that despite almost identical values for IDWA, there are stark differences in some of the components. The comparatively high use index in India, for instance, does not mean much when one takes cognizance of the relatively poor quality.

Both IDWA and WPI indicators are available for 21 economies. The simple correlation coefficient between the two is 0.63, not too high and not too low. Thus, IDWA is an effective alternative to WPI, after removing what are believed to be either unnecessary or inadequate components of the latter.

IDWA Limitations and Possibilities

Limitations

IDWA numbers are as good as the components that go into them. Of all the components, the one on shakiest foundations is the proxy used for water quality, namely, diarrheal death rate. It would have been better if a more direct water quality measure was available. The data gap here serves as a clarion call for water testing on a routine basis in as many cities and villages as possible and ensuring the availability of the information. What use is water in large quantities if quality is poor and causes disease? Some think, quite rightly, that quality is so important that giving it a weight equal to all other components is not acceptable. However, determining a weighting pattern for the five components is not feasible on a scientific basis.

Given the caveats and qualifications behind the data on which IDWA is based, it is of note that IDWA is not intended to provide a confirmed and strict ranking of countries in regard to access to safe drinking water on a sustained basis. It is up to economies concerned to benchmark in any way they like, learning from good practices of relatively better performers. IDWA and components could help in such a process.

Does IDWA really identify the best performers? Much depends on the components that go into IDWA. For this first analysis, we used five components, which are all important. Yet, Singapore, the region's top performer in providing excellent drinking water does not score 100 if all five components are considered, but scores 100 if internal resource is excluded (Box 3). This does not imply that one must take indicators based on which country gets what score; it shows that composite indicators differ depending on components considered.

Box 3: Singapore's Significant Success

Despite lack of sufficient internal water resources (142 cubic meters per capita in 2004 as per the World Development Indicators, 2006), Singapore has done exceptionally well in regard to provision of top quality drinking water to its population. In addition to sourcing water from outside, it has developed not only desalination, but most importantly, what is known as 'NEWater', drinking water of great quality obtained from purification of recycled water.

In Singapore, the water supply is continuous and one can drink it straight from the tap. The country scores 100 on each of four IDWA components (access, capacity, use, and quality). Yet, because of an index value of 42 for the resource component, the IDWA based on five components is 88, lower than the values for Malaysia and the Republic of Korea (92 and 90, respectively).

Without the resource component, IDWAs for Malaysia and the Republic of Korea are 94 and 97, respectively, less than the 100 of Singapore. These differences are inevitable in any composite indicator and that is precisely why we have opted for a small number (five) of important components.

Possibilities

IDWA can be fine-tuned depending on data availability and as per the desired focus. For instance, given the tremendous significance attached to quality of drinking water, such quality indicators as dissolved oxygen concentration and suspended solids could be considered and combined into a quality index that can then enter the final composite IDWA. Alternatively, if some of the key quality indicators are inter-correlated and if one that is most critical can be ascertained, that can be included in IDWA and the number of components can be kept small.

In its present form, IDWA is limited to water. It could be expanded to include sanitation if at least one or two good sanitation indicators were available, not only reflecting access to toilet facilities but also waste collection and disposal and sewerage treatment. A separate composite index for sanitation too could be considered as the database is improved.

MDG Fine-tuning: Inclusion of Housing[21]

Rationale for the MDG and Critical Nature of Housing

Even in circumstances of sustained high rates of economic growth, as long as capabilities are highly unequal among the people, income and wealth distributions will not be moderated by the forces that generate growth. Neither free markets nor global economic integration can make a contribution to fairness in the distribution of capabilities. However, international action has been initiated, in terms of the MDGs, to make a dent on some of the gross intra-national and international inequalities in the building blocks behind human capabilities.

Whether to promote healthy childhood and thus improve educational achievements, or to ensure healthy and productive working life, the water and sanitation targets under the MDGs are very important. How does one go about delivering/achieving them?

Some believe it is adequate to supply water on a community or group basis from a bore well or via a tanker. The information in Table 1, however, underscores the importance of a house connection.

Even if it makes sense to have drinking water provision on a community basis, it is a disgrace to apply such a philosophy to toilet facilities. It is not an exaggeration to say that the first item on the agenda of women's empowerment must be to ensure that every woman has access to a private toilet. This is no exaggeration, as the following account affirms.

The State Government of Andhra Pradesh, India, recently launched a mass housing program (Box 4). Four-floor buildings containing apartments with kitchen and bathroom are being constructed as part of the program in urban areas. A friend of the author shared the information that her maid received a flat and expressed great joy not only because of her new and proud possession, but also because she did not have to go out of home for defecation, since she now has her own private toilet.[22]

The Global Water Supply and Sanitation Assessment 2000 refers to a survey of rural households in the Philippines, which provides a listing in order of importance of the reasons for preferring a proper toilet: lack of flies, cleaner surroundings, privacy, less embarrassment when friends visit, and reduced gastrointestinal disease.

Inclusion of Slum Dwellers

The case for housing as an important goal is further affirmed by considering the plight of slum dwellers. As revealed by the inter-correlations in Table 2, the higher the proportion of the slum population, the lower is access to improved sanitation. It may not be very difficult to provide slum dwellers with drinking water by hook or crook, but it is certainly not feasible to provide decent toilet facilities unless each and every family has access to a private toilet, the achievement of which calls for housing programs and investments.[23]

Notwithstanding the laudable initiatives, often by civil society organizations, in providing community toilets, they could at times mean health hazards (Box 5). A common deprivation faced by women in slums and poor women in rural areas in some of the developing countries

Table 1: Housing, Water and Health

Service level	*Distance/time*	*Likely volume of water collected*	*Health risk*
No access	More than 1 kilometer, over 30 minutes round trip	Very low, 5 liters per capita per day	Very High
Basic access	Less than 1 kilometer and 30 minutes	About 20 liters per day	High
Intermediate access	At least one tap in premises or close by	About 50 liters per capita per day	Low
Optimal access	Water supply within house with more than one tap	100–200 liters per day	Very Low

Adapted from WHO. 2004. Domestic water quantity, service level and health. Geneva: WHO (quoted in WHO-UNICEF, 2005).

Box 4: Providing Drinking Water and Sanitation Excerpts from an Andhra Pradesh (India) Government Programme

Bearing the name of the former Prime Minister of India, Mrs Indira Gandhi, the Andhra Pradesh programme is described as INDIRAMMA, the acronym for "Integrated Novel Development in Aural Areas & Model Municipal Areas".

"The primary aim of this programme is to provide in every village pucca houses, drinking water supply, individual sanitary latrines, drainage, power supply to every household, Road facilities for transport, pensions to eligible old age persons, weavers, widows and the disabled, primary education to all, special nutrition to adolescent girls/pregnant and lactating women and better health facilities in all the villages over a period of three years in a saturation mode..."

Among the identified activities under the program, the most critical is 'Housing for All', with the following objective(s): Every eligible houseless family shall be provided with house. Families below poverty line, living in thatched, semi-permanent, and rented houses will also be covered. Beneficiaries will have to pay Rs 220 (around US$3) per month toward loan repayment to make the program sustainable. Village governments are to educate the people to pay property tax and water tax on a regular basis to ensure service quality and sustainability.

Based on the Andhra Pradesh Government Website "Indiramma.com"

is the extent to which they struggle to find a public place that is private enough to emerge as a temporary toilet facility. At stake, therefore, is the dignity of women, assuring which calls for a private toilet, which in turn calls for housing, which should have the highest priority on the agenda of women empowerment.

Fine-tuning the MDGs by Including Housing

Most of the MDGs are to be achieved by 2015. At the present half-way point, it is useful to specifically incorporate within the MDGs, the target of "housing the homeless", homeless being inclusive of those without proper housing. More than any other developmental activity, housing is the key for people to have a stake in the country and live in peace and security. Further more, it could be vital for children to stay healthy and study well. A host of economic, social, and other developmental benefits have accrued to the people of Singapore over the years, thanks to the well known housing program of the country.

MDGs are not cast in steel. They can and should be modified where necessary, and should include housing, as part of the goal to provide sustainable and safe/good water and sanitation on an economically viable basis, with cross subsidization as needed.

Table 2: Percentage of Population in Slums and Access to Water and Sanitation

Access indicator	*Correlation with proportion of urban population living in slums*	
	1990 (Sample size: 40)	2004 (Sample size: 30 to 32)
Access to improved water source (%)	–0.42	–0.35
Access to improved sanitation (%)	–0.65	–0.66

Water and Sanitation Data: Evaluation and Implications

Given that achievement of the MDGs is an international commitment for the betterment of humanity at large, it is only natural that due attention be given to proper conceptualization of the indicators that reflect MDG targets and achieve-

Box 5: Community Toilets are Nothing Short of Community Health Traps

"Other factors typically contribute to the pollution of the area around a toilet block. The shortage of toilet facilities means that children are often pushed out of queues at busy times or may have difficulty waiting to use a toilet. It is thus generally accepted that children defecate in gutters or on open ground outside the toilets. Since the area around a toilet block is already dirty and malodorous, it is the obvious place for residents to dump their garbage. Flies, mosquitoes, and pigs are attracted and this part of a settlement becomes more polluted. In high-density settlements, toilets are unlikely to be located at any distance from dwellings, so people's homes are located adjacent to these hazardous areas."

Source: Hobson, Jane. 2000. Sustainable Sanitation: Experiences in Pune with a municipal-NGO-community partnership. *Environment and Urbanization*, 12.

Table 3: Comparing Indicators from ADB, UNICEF, World Bank and UN

Comparison	*No. DMCs covered*	*Difference if any*
(A). ADB Key Indicators 2006, & (B). UNICEF Progress for Children, 2006	Urban: 42 for water and 41 for sanitation in A and 40 and 39 in B. Rural: 40 and 39 in A and 40 and 38 in B	For India in A the data for urban sanitation is given as 54, while it is given as 59 in B.
(A). World Bank Global Monitoriang Report 2007, & (B). UN MDG Database	For water, 29 in A and 40 in B. For sanitation, 27 in A and 39 in B	No difference

DMC = Developing Member Country

ments. For the water and sanitation targets under MDG 7, there are standard indicator definitions and methods, and a lot of effort has gone into the measurement aspects (Box 6).

Fortunately, the various agencies that publish indicators on access to water and sanitation bring out almost identical numbers. The evidence in Table 3 speaks well on this for Asian countries, which are the focus of this paper. Thus, there is no issue of major discrepancies across agencies reporting access data.

The fact that most international agencies are using the same indicators does not mean much unless the data reliability is tested and confirmed. However, an indirect evaluation has been attempted by comparing the relationships between water, sanitation, and other indicators.

The Water and Sanitation Information Website of the Joint Monitoring Programme of the World Health Organization and the UN Children's Fund has excellent country pages that provide the basic data available from surveys and censuses. Based on them, for each country, one or more tables on house connections for water and sanitation for rural and urban regions are shown. We could assemble, for one or more years between 1987 and 2003, data on the percentage of families served by house connections for water and sanitation. Juxtaposing the data with averaged water and sanitation access rates for 1990 and 2004, the correlations shown in Table 4 are obtained.

The correlations indicate, with the exception of access to water in urban areas, relatively weak links between house connections and overall access rates. Two interpretations can be suggested. One is that it does not matter if a house connection is available or not for defining access. This may not be an acceptable proposition if one were to ensure the same idea and basket of goods and services to constitute development for one and all (see Annex 2). Also, there does seem to be variation in what constitutes access: In India, to assess protected water supply coverage, the yardstick used is 40 LPCD within a 1.6-kilometer radius.[24] This is short of the WHO recommendation of 50 LPCD at the consumer end, which itself is termed intermediate-level access.

Table 4: Correlations between House Connections and Access

	Urban	*Rural*
Water [n]	0.65 [22]	0.40 [20]
Sanitation [n]	0.49 [19]	0.39 [16]

Another and relatively more important interpretation of the correlations is that access estimates, because they are not fully reflective of the availability of house connections, must be treated as aggregations of all sorts of water/sanitation facilities (see Box 5), which may or may not be internally consistent and comparable across countries.

No independent evaluation can be made of the

Box 6: Water and Sanitation Indicators, Definitions, and Computation Methods

Indicators Proportion (%) of population with sustainable access to an improved water source, and improved sanitation, urban and rural.

Definitions

Water: Percentage of the population using improved drinking water sources (including household water connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection and bottled water—if a secondary available source is also improved).

Sanitation: Percentage of the population using improved sanitation facilities (including flush to piped sewer system, flush to septic tank, flush/pour flush to pit, flush/pour flush to elsewhere).

Methods of Computation: Data from household surveys and censuses are adjusted to improve comparability over time. Survey and census data are then plotted on a time scale from 1980 to present. Four graphs for each country show both urban and rural coverage for water and sanitation. A linear trend line, based on the least-squares method, is drawn through these data points to estimate coverage for 1990 and latest available year.

Source: http://mdgs.un.org/unsd/mdg/Metadata.aspx?IndicatorId=0&SeriesId=667

Table 5: Correlation Coefficients for Water and Sanitation Access and Infant Mortality Rate: Asian and Global Samples (number of countries in parentheses)

	Asia	*Global*
Water access	–0.70 (35)	–0.80 (131)
Water: House connections	–0.43 (33)	–0.74 (118)
The difference is statistically significant at 5% level of probability within asia, between correlations with access and with house connections, while it is not so globally. Almost as a corollary,the global and Asia difference is statistically significant (at 1% level of probability) only in regard to house connection correlations.		
Sanitation access	–0.72 (33)	–0.83 (123)
Sanitation: House connection	–0.41 (24)	–0.55 (89)
The difference between the two correlations is statistically significant at the 5% level within Asia.		

indicators used in the MDG for water and sanitation goal setting and monitoring. Some indirect inferences, however, can be drawn from the statistical and interpretative information in Tables 5–7.

The anomalies in the various correlations in the three tables point to the possibility of deficiencies in the data on access to water and sanitation. For instance, the differences between Infant Mortality Rate (IMR) correlations with access and house connections for water are statistically significant at 5% level of probability within Asia, but not globally (Table 5). The same holds true for sanitation. House connection data in Asia are perhaps faulty. The globally low correlation between house connection for sanitation and IMR in comparison to access and IMR has similar implications. International institutions should investigate how water and sanitation data on house connections and overall access are collected.[25]

Summary of Action Points

An important dimension of inclusive growth is the achievement of universal access to water and sanitation. However, it is not any form of access but sustained and quality access.

IDWA, the index proposed in this paper, is simple to interpret. Its components indicate directions for actions. Monitoring the indicator over time would help achieve better drinking water access. If adequate data were forthcoming, IDWA could incorporate sanitation as well.

At the present half-way point in the MDG time frame, it is suggested that the goals on water and sanitation be fine-tuned to incorporate a goal to achieve a house for every family, which will help deliver water and sanitation by way of house connections.

Mounting a special effort at data evaluation is very much needed, given the anomalies in regard to differences in the relationships between water and sanitation access indicators and mortality rates at global and Asian levels.

Endnotes

1 Streeten, P. 1994. Human Development: Means and Ends. *American Economic Review, 84*, 2: 232–237.

2 The MDGs, endorsed by 147 heads of State and Government, and 191 nations in all, are listed below. MDG 1: Eradicate Poverty & Hunger; MDG 2: Achieve Universal Primary Education; MDG 3: Promote Gender Equality; MDG 4: Reduce Child Mortality; MDG 5: Improve Maternal Health; MDG 6: Combat HIV AIDS, Malaria and Other Diseases; MDG 7: Ensure Environmental Sustainability; MDG 8: Develop a Global Partnership for Development. Each of the above has one or more subgoals. Goal 7 has three: Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources; Reduce by half the proportion of people without sustainable access to safe drinking water; and Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020.

3 Lack of access to drinking water could be termed as the worst form of vulnerability, the key aspect of poverty that has received attention in Tandon, Ajay and Hasan, Rana. 2005. Conceptualizing and Measuring Poverty as Vulnerability: Does It Make a Difference? ERD Policy Brief Number 41. Manila: Asian Development Bank.

4 As clarified in ADB publications like the *Asian Development Outlook* and the *Key Indicators*, the term country is used for convenience and not to convey any approval of national status. Thus, for instance, Hong Kong is shown separately even though it is part of the People's Republic of China.

5 There have been a few further explorations on WPI by the authors and these are: Sullivan, Caroline, Jeremy Meigh, and Peter Lawrence. 2005. Application of the Water Poverty Index at different scales – a cautionary tale, Agriculture, ecosystems and environment; Sullivan, C.A. and J. R. Meigh. 2003. Considering the Water Poverty Index in the context of poverty alleviation, Water Policy, 5, 513–528; Sullivan, C. A. and J. R Meigh. 2003. Access to Water as a Dimension of Poverty: The need to develop a Water Poverty Index as a tool for poverty reduction. In Water Development and Poverty Reduction, edited by Olcay Ünver I. H., Gupta R. K. and A. Kibaroðlu. Boston: Kluwer; Sullivan, C. A. 2003. The Water Poverty Index: A new tool for prioritisation in water management. World Finance.

6 The justification given for taking the log scale was "to reduce the distortion caused by high values".

7 One must not give the impression that taking just one crude indicator on sanitation is good enough for taking care of the vital human need for sanitation.

8 For a comprehensive description and analysis of the Singapore case, see Tortajada, Cecilia. 2006. Water Management in Singapore. *Water Resources Development, 22* (2), 227–240.

9 World Economic Forum et al. (2001), quoted in the references cited in endnote 5.

10 The focus here is limited to ADB's developing member countries (DMCs).

11 In 2004, access rate in urban areas was anywhere between 75 to 100 percent in all except Fiji, Afghanistan and Cambodia. The situation was not as good in the

Table 6: Correlation Coefficients for Water and Sanitation Access and Under 5 Mortality: Asian and Global Samples (number of countries in parentheses)

	Asia		*Global*	
	Males	*Females*	*Males*	*Females*
Water access	–0.81 (43)	–0.76 (43)	–0.80 (172)	–0.79 (172)
House connection	–0.53 (39)	–0.51 (39)	–0.77 (138)	–0.77 (138)
Within Asia, access and house connection correlations differ significantly at the 5% level. It is not the case globally. The global and Asia difference is statistically significant (at 1% level of probability) only in regard to house connection correlations.				
Sanitation access	–0.72 (38)	–0.71 (38)	–0.78 (162)	–0.78 (162)
House connection	–0.46 (31)	–0.43 (31)	0.62 (106)	–0.61 (106)

Table 7: Correlation Coefficients for Water and Sanitation Access and 15–60 Age Group Mortality: Asian and Global Samples (number of countries in parentheses)

	Asia		*Global*	
	Males	*Females*	*Males*	*Females*
Water access	–0.76 (41)	–0.79 (41)	–0.60 (172)	–0.62 (172)
House connection	–0.57 (40)	–0.67 (40)	–0.62 (138)	–0.66 (138)
The global and Asia differences are significant at 5% level in regard to access correlations but not house connections. Within Asia, differences are significant between access and house connection correlations at 5% level for males and 10% level for females. This is not so globally.				
Sanitation access	–0.65 (39)	–0.79 (39)	–0.64 (162)	–0.68 (162)
House connection	–0.46 (32)	–0.47 (32)	–0.45 (106)	–0.50 (106)
The male-female difference in correlations with access is significant at 10% level for Asia. It is not so for house connections and it is not so globally for either access or house connections. Globally, house connection correltations and access correlations differ significantly at the 5% level for males and females. Within Asia, it is so only for females.				

rural areas, but even there, in 30 of the 44 economies, the access rate was 60 percent or more.

12 Here is the definition used in the MDGs for access to water: Percentage of the population using improved drinking water sources (including household water connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection and bottled water—if a secondary available source is also improved). The measurements based on this definition are briefly evaluated in this paper.

13 Internal Renewable Water Resources (IRWR) comprises the average annual flow of rivers and recharge of groundwater (aquifers) generated from endogenous (internal) precipitation. Natural incoming flows originating outside a country's borders are not included. The total flow is given in billion cubic meters and per capita flow in cubic meters.

14 The Malaysian rate was shown as 99 in the UN database. It is rounded off to 100 here.

15 We could have used the global maximum, the US figure of $40,000. However, our aim, as far as possible, is for one of the DMCs to have the maximum index value of 100, except when unjustified. In the case of per capita income, as long as the level is high enough, it reflects the capacity to procure water, even if internal water resources are not available.

16 Annual Total Water Withdrawals is the gross amount of water extracted annually from any source, either permanently or temporarily, for a given use. It can be either diverted towards distribution networks or directly used. It includes consumptive use and conveyance.

17 The author is grateful to Narciso Prudente (ADB Research Assistant for the AWDO project) for the data compilation.

18 Among over 200 countries, the maximum of 370 was observed for Angola, and eight countries have estimates close to zero: Ireland, Lithuania, Portugal, Slovakia, Poland, Italy, Austria, and Czech Republic have each a level of 0.1.

19 The formula (100–country value)*100/(100–0) simply means 100–country value.

20 The IDWA reported in this table is the one chosen from two more alternatives that use additional components. Details are in Annex 1.

21 This section in part draws on the author's article in *BusinessLine* of 15 May 2007 entitled "The Missing Millennium Development Goal".

22 "Development" should not mean different things to different people – one definition and basket for the poor and one for the rich. See Annex 2 for the writer's biographical account on development.

23 As shown in the manual prepared and issued by WaterAid (WaterAid. 2004. Manual for Valuing the Benefits of WaterAid's Water and Sanitation Projects. Water Aid., page 1), water and sanitation have one or more benefits within each of six categories: (1) health & hygiene, (2) livelihoods & incomes, (3) gender, (4) education, (5) community management & sustainability, and (6) Psychological. For each of these, the WaterAid manual gives a key sheet to help quantify the impacts.

24 See Annex 3 for the data from diverse Indian sources and how they compare.

Annex 1

IDWA Estimates: Two Alternatives

In addition to the five component indicators discussed, two more components are considered for inclusion and two alternative IDWA estimates have been compiled. These are termed IDWA-1 and IDWA-2, which take account of one additional component each respectively. IDWA 1 has the addition of priority for domestic use, while IDWA-2 has the addition of secure access in urban areas via urban house connections.

Table A1-1: Index of Priority for Domestic Use

Country	*Priority*
Azerbaijan	25
Bangladesh	30
Cambodia	15
PRC	32
India	35
Indonesia	37
Kazakhstan	10
Korea, Rep. of	155
Kyrgyz Republic	15
Lao PDR	30
Malaysia	70
Mongolia	103
Myanmar	20
Nepal	10
Pakistan	10
Papua New Guinea	98
Philippines	70
Sri Lanka	10
Tajikistan	20
Thailand	20
Turkmenistan	8
Uzbekistan	23
Viet Nam	33

Priority for Domestic Use

To the extent governments can set/influence priorities, utmost priority should go for drinking and other domestic uses of water relative to all other uses. As for ground reality on the priority dimension, the percentage of water used for domestic purposes varies from 2 in Kazakhstan, Nepal, and Pakistan to 31 in the Republic of Korea. For computing an index of priority, we take a norm based on a set of 17 high-income economies.[1] Among them also, the percentage of water for domestic use varies from a low 6 to a high 48. The median value is 19, which can be rounded to 20. Setting that as the norm, the index of priority is obtained as follows: simply take the percentage for domestic use for each country in the sample and express it as a percentage of the norm of 20. The indicator values are given in Table A1-1.

Urban In-House Connection Rates

The urban house connections data have been compiled from the individual country data sheets of the Joint Monitoring Program of WHO and UNICEF. The basic data from national sources and the estimates for 2003/4 are reproduced in the Table below.

Table A1-2: Water: Urban House Connections, 1995–2004

Percent of Households with House Connections from National Surveys and Estimates from WHO/UNICEF

Economy	*1995–1999*	*2000–2002*	*WHO/UNICEF 2002*	*2003*	*2004*	*2004 from Wat San Database*
Bangladesh	28.3	24.2		25.3	23.3	24
Cambodia		32.5			35.5	36
PRC	86.5	84.2	91			87
India	52.7	46.7	51			47
Indonesia	30.4	27.8	31	31.2	28.4	30
Kazakhstan	88.7		88			Not given
Korea, Rep. of						96
Lao PDR		35.3	25	53.3		44
Malaysia				98		98
Maldives	77	76.1				Not given
Mongolia	46.7	43	49			49
Myanmar	16.4	21.2	23	13.1		16
Nepal	46	48.5	48	54	53	52
Pakistan	52	50.2	50	56.2		49
Papua New Guinea	60.5		61			61
Philippines	49		60	56		58
Solomon Is.						76
Sri Lanka		35.5	35		30.6	32
Thailand		80	80			85
Vanuatu	75.2		73			74
Viet Nam	51.2	62.2	51			73

Alternative IDWA Sets, Correlations, and Implications

The inclusion of each of the two aforementioned components gives the two alternative sets of IDWA shown in Table A1-3. Inter-correlation between them is 0.94. The correlation coefficients between IDWA given in the text and IDWA-1 and IDWA-2 respectively are 0.95 and 0.99.

IDWA-1 is unacceptable for a simple and logical reason. It incorporates the indicator of priority given for drinking water. While it is a good idea to gauge the degree of priority, it is likely that many developing countries with large proportions of people depending on agriculture might accord a relatively high priority to irrigation and this might reduce the efficacy of the index of priority for drinking water.

IDWA in the text and IDWA-2 are equal in many ways because the correlation is near perfect at 0.99. The decision to ignore IDWA-2 is based on the premise that the data on house connections are relatively weak.

Table A1-3: Alternative IDWA Estimates

Economy	*IDWA-1*	*Economy*	*IDWA-2*
Korea, Rep. of	100	Malaysia	93
Malaysia	89	Korea, Rep. of	91
Philippines	78	Kazakhstan	76
Viet Nam	69	Philippines	76
Azerbaijan	66	Viet Nam	76
Thailand	64	Thailand	75
Uzbekistan	64	Azerbaijan	74
Kazakhstan	63	Kyrgyz Republic	74
Kyrgyz Republic	63	Uzbekistan	74
Mongolia	61	Turkmenistan	66
PRC	56	PRC	66
India	56	Tajikistan	65
Indonesia	55	India	58
Tajikistan	55	Indonensia	54
Turkmenistan	53	Mongolia	52
Sri Lanka	44	Sri Lanka	48
Papua New Guinea	43	Pakistan	40
Bangladesh	36	Nepal	40
Pakistan	34	Papua New Guinea	37
Nepal	33	Bangladesh	35
Myanmar	33	Lao PDR	33
Lao PDR	30	Myanmar	32
Cambodia	19	Cambodia	22

Endnotes

1 The following are the percentages of total water used for domestic purposes: Netherlands 6; Australia 15; Canada, Japan 20; Switzerland 24; Germany 12; France 16; UK 22; Denmark 32; Spain, USA 13; Italy 18; Norway 23; Austria 35; Finland 14; Russian Fed 19; New Zealand 48.

Annex 2

Water, Sanitation, and Development: Writer's Biographical Account

When I was about three-years old, my father acquired a home with two rooms and a small courtyard in the front. My childhood memory was one of keeping a vessel in line before a public tap, across the street and away from our home and waiting for the tap to bring water (it used to make a particular noise to signal that it would spout water soon). Once the water was flowing, my mother and I waited for our turn. It was a great thrill when we finally obtained a vessel full of trusted and safe water. Things at times used to get nasty when a woman or man jumped the queue.

By the time I was thirteen, we could afford a municipal tap connection at home, which ended our family's underdevelopment in regard to water. Water was flowing through the tap for less than an hour, but this did not pose much of a problem since we had enough storage provisions.

When it came to the possession of a decent toilet, we had to wait longer. In my late 20s, I used my first lot of savings from abroad to construct a latrine connected to a septic tank at one extreme corner of the small yard of our home. It was a great thrill to my parents. Most important was the satisfaction emanating from the freedom from running to the nearby open places or fields.

> Development is when one has a house that can be called home, with private water and toilet facilities. What is development to me is no different from what it is to the poorest of the poor.

Annex 3

Water and Sanitation Access in India: A Note on Diverse Data Sets

Summary

The tables given in this note are self explanatory. The main point is that there are some differences in the access rates from diverse data sets on the one hand and those reported in global data sets on the other.

Sources of Data

This note is based on the data from the Indian censuses of 1981, 1991, and 2001 as well as the following National Sample Surveys (NSS):

- NSS 44th round, 1988–89.
- NSS 49th round, 1993
- NSS 54th round, 1998
- NSS 58th round, 2002

Access Rates

Table A3-1: Household Data for Rural Water Access

Source of drinking water	*1981 Census*	*1988–89 NSS*	*1991 Census*	*1993 NSS*	*1998 NSS*	*2001 Census*	*2002 NSS*
Tap	10.3	15.5	20.5	18.9	18.7	24.3	27.5
Well	61.7	39.1	38.0	31.7	25.8	22.2	17.9
Tube well & hand pump	16.2	39.1	34.9	44.5	50.1	48.9	51.3
Subtotal	**88.1**	**93.7**	**93.4**	**95.1**	**94.6**	**95.4**	**96.7**
Tanks & ponds	3.4	2.2	1.7	2.1	1.3	1.3	1.2
River, lake, & canal	5.0	2.4	2.6	1.7	1.3	1.3	1.1
Other sources	3.6	1.7	2.2	1.2	2.7	1.9	1.1
Subtotal	**11.9**	**6.3**	**6.4**	**5.0**	**5.3**	**4.5**	**3.4**
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: ADB KI 2006 shows 64% and 83% for 1990 and 2004, respectively. From the data for 1991 and 2002 above, it would seem that if the numbers are based on tap and tube well or hand pump, then we have 55% for 1991 and 79% for 2002. The former is out of line with the KI data for 1990, but the latter is in line with the 2004 estimate in KI.

Table A3-2: Household Data for Urban Water Access

Source of drinking water	*1981 Census*	*1988–89 NSS*	*1991 Census*	*1993 NSS*	*1998 NSS*	*2001 Census*	*2002 NSS*
Tap	63.2	72.1	65.1	70.4	70.1	68.7	73.6
Well	20.4	9.2	15.9	8.6	6.7	7.7	5.1
Tube well & hand pump	11.8	17.2	16.3	18.5	21.3	21.8	19.6
Subtotal	**95.5**	**98.5**	**97.3**	**97.5**	**98.1**	**98.2**	**98.3**
Tanks & ponds	0.9	0.3	0.3	0.8	0.2	0.3	0.2
River, lake & canal	0.7	0.3	0.4	0.1	0.2	0.2	0.1
Other sources	2.9	0.9	2.0	1.5	1.3	1.7	1.4
Subtotal	**4.5**	**1.5**	**2.7**	**2.4**	**1.7**	**2.2**	**1.7**
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: KI estimates are 89% and 95%. The former is identical to the estimate from 1988–89 NSS. But then why should the rate go down as per the 1991 Census?

Table A3-3: Household Data for Rural Sanitation Access

Sanitation facility	*1988–89 NSS*	*1991 Census*	*1993 NSS*	*1998 NSS*	*2001 Census*	*2002 NSS*
Flush system	1.06	—	0.8	2.9	—	—
Tank system	3.70	—	5.5	7.5	—	11.7
Subtotal	**4.76**	**—**	**6.3**	**10.4**	**7.1**	**11.7**
Service latrine	1.62	—	2.4	2.7	—	1.9
Other types	4.37	—	5.5	4.3	4.5	1.6
Pit	—	—	—	—	10.3	8.4
Latrine available/ Subtotal	**5.99**	**9.5**	**7.9**	**17.4**	**14.8**	**11.9**
Latrine not available	**89.25**	**90.51**	**85.8**	**82.5**	**78.1**	**76.3**
Total	100.0	100.0	100.0	100.0	100.0	100.0

Access numbers in KI are 3% and 22%. The figure from 1988-89 NSS would be either 1% or 4.8%. The latter figure is not accessible from the census or NSS estimates.

Table A3-4: Household Data for Urban Sanitation Access

Sanitation facility	*1988–89 NSS*	*1991 Census*	*1993 NSS*	*1998 NSS*	*2001 Census*	*2002 NSS*	*2002 NSS*
Flush system	26.98		28.5	8.4	—	—	—
Tank system	25.87		29.6	35.2	—	28.5	—
Subtotal	**52.85**		**58.1**	**43.6**	**46.1**	**28.5**	**—**
Service latrine	11.75		7.4	5.9	—	2.6	—
Other types	4.29		3.9	25.0	13.0	1.4	—
Pit	—		—	—	14.6	7.8	—
Latrine available/ Subtotal	**16.04**	**63.9**	**11.3**	**30.9**	**14.8**	**11.8**	**63.0**
Latrine not available	**31.11**	**36.2**	**30.6**	**25.5**	**26.3**	**59.8**	**18.0**
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Respective KI figures for 1990 and 2004 are 45% and 54%. It is not possible to find comparable census or survey estimates.

Annex 4A

Water Delivery and Related Performance Indicators, 2003 for 47 Utilities in Countries of the SEA Region

The SEAWUN Database[1]

The SEAWUN Effort

The Southeast Asia Water Utilities Network (see www.seawun.org) has done great service in developing a broad database on 47 water utilities of the region. The pioneering effort, which began in 2004, obtained detailed data for 2003 from each of the utilities. Popularly known as the SEAWUN Benchmarking Programme, the data collection and analysis were supported by ADB. The 47 participating water utilities are listed below. It is important to note that they represent about 2% of the estimated total in Southeast Asia.

Table A4A-1: Country and Utility Coverage

Country	*Companies/Utilities*
Viet Nam [11]	Hue Water Supply & Drainage Company Ho Chi Minh Water Supply Company Binh Duong Water & Drainage Company Hai Phong Water Supply Company Can tho Water Supply & Drainage Company Phu Tho Water Supply Company Dong Thap Urban Water Supply, Sewerage& Environment Co Da Nang Water Supply Company Hanoi Water Business Company Lam Dong Water Supply Company Vinh Long Water Supply Company
Lao PDR [1]	Vientiane City Water Supply Enterprise
Cambodia [1]	Phnom Penh Water Supply Authority
Malaysia [4]	SAJ Holdings Sdn Bhd Sibu Water Board Perbadanan Bekalan Air Pulau Pinang Sdn. Bhd Syarikat Air Terengganu SDN. Bhd
Thailand [4]	Provincial Waterworks Authority Universal Utilities Eastern Water Resources Development & Management PC Metropolitan Waterworks Authority

Indonesia [15]	PDAM (Perusahaan Daerah Air Minum) Kabupaten Purwakarta PDAM Kabupaten Sleman PDAM Kota Padang Panjang PDAM Kota Pangkal Pinang PDAM Kabupaten Pandeglang PDAM Tirta Marta Yogyakarta PDAM Kabupaten Banyumas PDAM Tirta Sakti Kab. Kerinci PDAM Tirta Sukapura Kabupaten Tasikmalaya PDAM Kota Surakarta PDAM Bandarmasih Banjarmasin PDAM Tirta Pakuan Kota Bogor PDAM Kota Makassar PDAM Kota Malang PDAM Tirtanadi
Philippines [12]	Bansalan Water District Muñoz Water District Silay City Water District Tandag Water District Guimba Water District San Francisco Water District Santa Rosa (NE) Water District Victorias Water District Metro Carigara Water District Marilao Water District Dipolog City Water District

Data Collection: Subject Areas

The survey questionnaire covers nine subject areas plus contact information for purposes of communication, data checking and feedback of results. The requested data allows the comparative performance indicators referred to above to be calculated as well as categorizing of water utilities to compare utilities on a similar basis.

1. General: type of services and type of utility; private sector involvement
2. Service Area: area of responsibility; service area; population in area of responsibility; population in service area; population served; no. of towns served
3. Infrastructure Description: raw water source; treatment method; production capacity; distribution length; storage capacity; no. of connections; operating water meters; service connection length
4. Consumption & Production: produced by water utility; bulk water bought; metered consumption; un-metered consumption; meter inaccuracy; water billed/sold
5. System Performance: intermittent supply; supply duration; water mains pressure; water main pipe breaks; residual chlorine tests-required-performed tests-passed
6. Staff: employment type; no. of staff; training event participation; no. of training days; HRD expenditure
7. Customers: no. of new customers; no. of customer complaints; means of complaining; ways to understand customers; connection charges; fixed water supply charges; consumption charges; m^3/month water bill
8. Finance: water supply revenue; end of year accounts receivable; utility operating expenses; water supply operating expenses
9. Capital Investment: source of funds for capital investment; gross fixed asset values; debt servicing costs

Notes on Data and Limitations

Given the sample size limitations, such as just a few utilities represented from Thailand and only a small fraction of the Philippine water utilities, country trends and inter-country comparisons should be treated with caution. For instance, all water utilities from the Philippines are small (1,600–8,400 connections). The sample thus is not representative of the national profile.

While all water utilities provide piped water supply services, many of them (particularly in

Viet Nam) are also providing other services. Thus, costs and staff allocation, etc., are not strictly comparable across utilities and for water function alone.

Results in Brief

Service Coverage

Two service coverage performance indicators were calculated: coverage in the area of responsibility and coverage within the existing service area. Shortfalls within the existing service area are due to inability of water utility to attract new customers. Difference between the existing service area and area of responsibility is due to unavailability of investment to expand into these areas. While there is certainly much variation between water utilities within countries, comparing averages for countries, it is clear that while service coverage in existing areas are generally of the same order (between 60% and 100%), the more developed countries and Phnom Penh are clearly more successful than the developing countries (~80% compared with ~40%) in attracting investment to expand their service coverage area. Phnom Penh is a special case, attracting significant investment after the civil war and a water utility that was able to effectively use this investment.

Meter Coverage

Nearly all water utilities have universal meter coverage (~100%) with only one exception in the Philippines, a water utility with 84% meter coverage.

Water Consumption Rates

The relatively more developed countries of Malaysia and Thailand use about 50% more water. The unexplained exception is Vientiane with it high rate. Also unexplained are the apparent very low rates for some water utilities. Overall for developing countries, the domestic consumption rate is about 90 liters per person per day increasing to 150–200 liters per person per day for more developed countries. These figures are for metered consumption. For water input (production plus bulk water import), allowing for the fact that overall ~80% of consumption is for domestic purposes, the production rate for domestic customers in developing countries is ~150 liters per person per day.

Customer Complaints

There are very clear differences in customer complaint levels, with Vietnam particularly low. The water utilities in the Philippines generally have a high level of interaction. Phnom Penh is a high performing water utility. It provides good service to its customers. It has a complaint level of 50 complaints per 1,000 customers per year, which is about the same as the median for the whole data set. A complaint level between 50 and 100 may be considered as desirable.

Non-revenue Water (NRW)

Countries do not differ much in the overall picture, but there are a number of "success stories" with water utilities below 20% NRW. These water utilities are the ones where there are some "lessons to be learned" in how to manage water losses (both physical and apparent) in a water supply system.

Comparing NRW to the number of connections, there is more variability between countries, but the Philippines is significantly lower (~50% lower) at a rate of ~200 liters per connection per day. There appear to be some lessons to be learnt from how the Philippine water utilities achieve these apparent low rates. It is also significant to note that Phnom Penh, which is among the best performers in NRW management, is low in both of these indicators.

Staff Issues

Staffing was an item poorly addressed. For the 20% of water utilities that provided other services as well as piped water supply, it is necessary to apportion their corporate staff between water supply and others services provided by the water utility. Only two water utilities provided any information on the number of staff working with these non-water supply services.

For corporate services, the number of staff performing these duties (expressed as a percentage of total staff) was quoted as varying from 10% to 90%. There is clearly an issue of definition of "corporate staff" that needs to be addressed in subsequent surveys.

Financial information

While the staff figures are inadequate to segregate overhead costs between water supply and other services, quoted overhead costs vary from 0% to 65% of total operating costs, a quite unrealistic situation. The same unacceptable variation occurs with the split up of water operating costs.

Assuming that at least the total operating expense and revenue figures are reliable, the "Operating Cost Coverage" ratio (the ability to at least recover operating expenses) was calculated. This varies considerably between water utilities. About 30% of water utilities appear to be non financial and dependent on other sources of revenue. Considering total revenue, this figure reduces to about 10% of water utilities.

Overall Performance Indicator (OPI)

Initially, the OPI was to be calculated as a weighted average of 14 different key performance indicators (KPI). Because of limitations in the base data, several of these were abandoned until good data become available and at most 12 (where data are available) are taken into account.

Lesson for the Future

In many water utilities, benchmarking is a relatively new concept and we need to allow time for development of systems for data collection, processing, and reporting, and for the benefits and value of benchmarking to be appreciated and become part of improved company management.

Endnote

1 This extract is based on the original paper by Gary McLay (An overview of the 2004 SEAWUN Benchmarking Program, Revision of paper prepared for June 2005 SEAWUN Convention).

Annex 4B

Some Messages from the SEAWUN Database

Private Sector Involvement Need Not Mean High Costs and Prices

The data in Table A4B1 for Cambodia seem to indicate a rather high price-to-cost ratio and this could be construed as what could happen if the private sector were to actively start supplying water. However, the charge mellows when one takes account of the ratios for Malaysia and Thailand that show ratios comparable broadly with other countries where relatively less private sector involvement is seen.

Town Size Does Not Matter for Extent of Coverage

The evidence in Table A4B2 shows the wide variation in the average town size covered by the utilities and related pertinent indicators. It turns out that town size has no clear relationship in regard to any of the parameters considered. The implication is that there may not arise any significant economies of scale in water delivery. If this is true, it is good news for both mega players as well as medium and small water producers. Customer complaints too are not related to town size and even the extent of service coverage.

More Metering, Less Staff, More Complaints

Table A4B3 has information on two key parameters, namely, percent of total domestic consumption metered and staff per 1,000 connections along with the complaint rate. Rather cautiously one could note that as metered consumption rate goes up, there is a likelihood of complaints going up and as staff strength moves up, the complaint rate may be relatively low.

Table A4B1: Price and Cost Indicators Based on SEAWUN Data

Country	*Number of utilities with private sector involvement*	*Unit water price (US cents/m^3 of metered cons.)*	*Unit water cost (US cents/m^3 of metered cons.)*	*Unit water cost (US cents/m^3 of system input)*	*Price to cost ratio: Metered consumption*	*Metered water price to system input cost*
Cambodia	1 of 1	31	11	9	2.8	3.4
Indonesia	4 of 15	16	17	10	0.9	1.6
Lao PDR	1 of 1	5	4	3	1.2	1.7
Malaysia	4 of 4	23	15	11	1.5	2.1
Philippines	2 of 11	33	24	18	1.4	1.8
Thailand	All 4	34	22	16	1.5	2.1
Viet Nam	5 of 11	16	14	10	1.1	1.6

Table A4B2: Town Size Served and Domestic-Non-domestic Ratios

	Utilities number	*Av. town size (population '000)*	*Service coverage in existing service area (%)*	*Domestic/non-domestic connections ratio*	*Domestic/non-domestic consumption rate ratio*	*Customer complaints per 1,000 connections*
Cambodia	1	1200	100	5.4	1.6	50
Indonesia	15	365	66	22.7	10.5	199
Lao PDR	1	93	72	7.6	3.5	NA
Malaysia	4	249	96	6.4	1.8	74
Philippines	11	18	78	12.7	8.3	230
Thailand	4	1023	72	4.9	1.2	171
Viet Nam	11	871	62	27.0	2.2	6

Table A4B3: Metered Consumption, Staff Strength and Customer Complaints

	Philippines	*Indonesia*	*Thailand*	*Malaysia*	*Cambodia*	*Viet Nam*
% of total domestic consumption metered	80	79	54	60	62	64
Water service staff per 1,000 connections	81	73	21	31	51	93
Customer complaints per 1,000 connections	230	199	171	74	50	6

An Observation on Utilities Data

Before embarking on comprehensive data collection of the SEAWUN type, the purposes of data collection should be clear to those collecting and those supporting it. For "benchmarking," the data could be useful and, in this case, it is even desirable to pause and take stock before going for the next lap.

Appendix Tables

Table 1: Resources

Country	*Resource per capita*	*Log of resource per capita*	*Index*
Azerbaijan	977	2.989895	58.143
Bangladesh	754	2.877371	55.9548
Cambodia	8,738	3.941412	76.6467
PRC	2,170	3.33646	64.8825
India	1,167	3.067071	59.6438
Indonesia	13,043	4.115377	80.0297
Kazakhstan	5,030	3.701568	71.9826
Korea, Rep. of	1,349	3.130012	60.8678
Kyrgyz Republic	9,121	3.960042	77.009
Lao PDR	32,878	4.516905	87.838
Malaysia	23,298	4.367319	84.9291
Mongolia	13,839	4.141105	80.53
Myanmar	17,611	4.245784	82.5657
Nepal	7,454	3.872389	75.3045
Pakistan	345	2.537819	49.3517
Papua New Guinea	138,775	5.142311	100
Philippines	5,869	3.768564	73.2854
Sri Lanka	2,575	3.410777	66.3277
Tajikistan	10,311	4.013301	78.0447
Thailand	3,297	3.518119	68.4151
Turkmenistan	285	2.454845	47.7382
Uzbekistan	623	2.794488	54.343
Viet Nam	4,461	3.649432	70.9687

Table 2: Domestic Consumption – Final Estimate

Country	*Estimate 1* *1987–2002* *Based on WDI-06*	*Estimates 2 and 3 (based on WRI)* *1987–95*	*Estimate for 2000*	*Average*	*Index*
Azerbaijan	311	299		305	242.6725
Bangladesh	55	44	47	49	–21.8159
Cambodia	21	9	17	16	–55.9095
PRC	100	60	95	85	15.51975
India	153	81	139	124	55.81365
Indonesia	94	67	86	82	12.65397
Kazakhstan	123	111	123	119	50.19397
Korea, Rep. of	408	378		393	333.234
Kyrgyz Republic	180	182		181	114.5879
Lao PDR	70	57		64	–6.62591
Malaysia	202	191		196	130.074
Mongolia	101	100		100	31.26974
Myanmar	20	20		20	–51.7662
Nepal	41	38		40	–31.1902
Pakistan	74	69	65	70	–0.38452
Papua New Guinea	6	22		14	–57.5169
Philippines	193	178	176	182	115.4228
Sri Lanka	40	31	37	36	–34.9477
Tajikistan	229	230		229	164.1884
Thailand	121	82		101	32.4248
Turkmenistan	305	16		161	93.4545
Uzbekistan	352	288		320	257.5259
Viet Nam	218	89	200	169	102.2035

Norms: Minimum 70; Maximum 167, based on the following Singapore data in LPCD

1995	1996	1997	1998	1999	2000	2001	2002	Average
172	170	170	166	165	165	165	165	167

PCD = Liters per capita per day, WDI = World Development Indicators, WFI = World Resources Institute

Table 3: Domestic Consumption Estimate 1

Country	*Population Average 1990–2000*	*1987–2002 (WDI)*			*LPCD*
		billion cubic meters	*% for domestic use*	*Cubic meters per capita*	
Azerbaijan	7.612	17.3	5	2,273	311
Bangladesh	118.4	79.4	3	671	55
Cambodia	10.5865	4.1	2	387	21
PRC	1205.35	630.3	7	523	100
India	927	645.8	8	697	153
Indonesia	192.6118	82.8	8	430	94
Kazakhstan	15.6168	35	2	2,241	123
Korea, Rep. of	44.9387	18.6	36	414	408
Kyrgyz Republic	4.614	10.1	3	2,189	180
Lao PDR	4.686	3	4	640	70
Malaysia	20.795	9	17	433	202
Mongolia	2.28	0.4	21	175	101
Myanmar	45.4525	33.2	1	730	20
Nepal	20.34	10.2	3	501	41
Pakistan	124.735	169.4	2	1,358	74
Papua New Guinea	4.44	0.1	10	23	6
Philippines	68.94213	28.5	17	413	193
Sri Lanka	17.367	12.6	2	726	40
Tajikistan	5.74425	12	4	2,089	229
Thailand	59.0375	87.1	3	1,475	121
Turkmenistan	4.43825	24.7	2	5,565	305
Uzbekistan	22.7	58.3	5	2,568	352
Viet Nam	71.82605	71.4	8	994	218

LPCD = liters captica per day, WDI = World Development Indicators, WRI = World Resources Institute

Table 4: Domestic Consumption Estimate 2 (based on WRI Data)

Year	Per capita (cubic meters)	% for domestic use	LPCD total	LPCD domestic
1995	2,186	5	5,989	299
1990	134	12	367	44
1987	66	5	181	9
1993	439	5	1,203	60
1990	588	5	1,611	81
1990	407	6	1,115	67
1993	2,019	2	5,532	111
1994	531	26	1,455	378
1994	2,219	3	6,079	182
1987	260	8	712	57
1995	633	11	1,734	191
1993	182	20	499	100
1987	102	7	279	20
1994	1,397	1	3,827	38
1991	1,267	2	3,471	69
1987	28	29	77	22
1995	811	8	2,222	178
1990	573	2	1,570	31
1994	2,095	4	5,740	230
1990	596	5	1,633	82
1994	597	1	1,636	16
1994	2,626	4	7,195	288
1990	814	4	2,230	89

LPCD = liters per capita per day, WRI = World Resources Institute

Table 5: Domestic Consumption Estimate 3 (based on WRI Data)

Country	Withdrawal Per capita cubic meters, 2000	Domestic use (%)	Total Consumption LPCD	Domestic Consumption LPCD
Bangladesh	576	3	1,578.082	47.34247
Cambodia	311	2	852.0548	17.0411
PRC	494	7	1,353.425	94.73973
India	635	8	1,739.726	139.1781
Indonesia	391	8	1,071.233	85.69863
Kazakhstan	2,238	2	6131.507	122.6301
Korea, Rep. of				
Kyrgyz Republic				
Lao PDR				
Malaysia				
Mongolia				
Myanmar				
Nepal				
Pakistan	1,187	2	3,252.055	65.0411
Papua New Guinea				
Philippines	377	17	1,032.877	175.589
Sri Lanka	678	2	1,857.534	37.15068
Tajikistan				
Thailand				
Turkmenistan				
Uzbekistan				
Viet Nam	914	8	2504.11	200.3288

LPCD = liters per capita per day, WRI = World Resources Institute

Table 6: Access to Water (%), 2004

Country	*Access (%)*	*Index*
Azerbaijan	77	71
Bangladesh	74	67
Cambodia	41	24
PRC	77	71
India	86	82
Indonesia	77	71
Kazakhstan	86	82
Korea, Rep. of	92	90
Kyrgyz Republic	77	71
Lao PDR	51	37
Malaysia	100	100
Mongolia	62	51
Myanmar	78	72
Nepal	90	87
Pakistan	91	88
Papua New Guinea	39	22
Philippines	85	81
Sri Lanka	79	73
Tajikistan	59	47
Thailand	99	99
Turkmenistan	72	64
Uzbekistan	82	77
Viet Nam	85	81

Norms	
Ethiopia	22
Andora	
to USA	100
Malaysia	99

Table 7: Capacity

Country	*GDP/capita PPP $ 2004*	*Log*	*Index*
Azerbaijan	3,810	3.580925	52
Bangladesh	1,970	3.294466	33
Cambodia	2,310	3.363612	37
PRC	5,890	3.770115	64
India	3,120	3.494155	46
Indonesia	3,480	3.541579	49
Kazakhstan	6,930	3.840733	69
Korea, Rep. of	20,530	4.312389	100
Kyrgyz Republic	1,860	3.269513	31
Lao PDR	1,880	3.274158	31
Malaysia	9,720	3.987666	79
Mongolia	2,040	3.30963	34
Myanmar	1,550	3.190332	26
Nepal	1,480	3.170262	25
Pakistan	2,170	3.33646	36
Papua New Guinea	2,280	3.357935	37
Philippines	4,950	3.694605	59
Sri Lanka	4,210	3.624282	55
Tajikistan	1,160	3.064458	18
Thailand	7,930	3.899273	73
Turkmenistan	1,860	3.269513	31
Uzbekistan	1,860	3.269513	31
Viet Nam	2,700	3.431364	42
Norms			
Malawi	630	2.799341	
Korea, Rep. of	20,530	4.312389	

GDP = Gross Domestic Product, PPP = Purchasing Power Parity

Table 8: Quality

Country	*Diarrheal death rate*	*Index*
Azerbaijan	11.1	88.92339
Bangladesh	47.4	52.58618
Cambodia	85.7	14.26196
PRC	8.3	91.67636
India	43.5	56.51898
Indonesia	16.3	83.6502
Kazakhstan	2.3	97.70722
Korea, Rep. of	0.5	99.46128
Kyrgyz Republic	13.0	86.96311
Lao PDR	98.5	1.524234
Malaysia	1.3	98.70938
Mongolia	33.8	66.23115
Myanmar	51.0	48.97905
Nepal	68.0	32.02894
Pakistan	79.0	21.02263
Papua New Guinea	42.9	57.06379
Philippines	15.6	84.43883
Sri Lanka	3.6	96.40555
Tajikistan	32.8	67.19987
Thailand	7.5	92.53457
Turkmenistan	22.9	77.11963
Uzbekistan	2.1	97.8817
Viet Nam	13.4	86.61205

Norms	
Angola	370.0
Ireland, Lithuania, Portugal, Slovakia, Poland, Italy, Austria, Czech. Republic	0.1

Table 9: Priority

Country	*Percentage of water for domestic use*			Average	Index
	WDI, 2006	*WRI*			
	1987–2002	*Some year during 1987–1995*	*Est. 2000*		
Azerbaijan	5	5		5	25.00
Bangladesh	3	12	3	6	30.00
Cambodia	2	5	2	3	15.00
PRC	7	5	7	6	31.67
India	8	5	8	7	35.00
Indonesia	8	6	8	7	36.67
Kazakhstan	2	2	2	2	10.00
Korea, Rep. of	36	26		31	155.00
Kyrgyz Republic	3	3		3	15.00
Lao PDR	4	8		6	30.00
Malaysia	17	11		14	70.00
Mongolia	21	20		21	102.50
Myanmar	1	7		4	20.00
Nepal	3	1		2	10.00
Pakistan	2	2	2	2	10.00
Papua New Guinea	10	29		20	97.50
Philippines	17	8	17	14	70.00
Sri Lanka	2	2	2	2	10.00
Tajikistan	4	4		4	20.00
Thailand	3	5		4	20.00
Turkmenistan	2	1		2	7.50
Uzbekistan	5	4		5	22.50
Viet Nam	8	4	8	7	33.33

WDI = World Development Indicators, WRI = World Resources Institute

Table 10: Urban House Connections and Overall Access Rates for Water

Country	Years	Number of Years	House connections (%)	Access 1994	Access 2004	Average
Afghanistan	1997–2003	2	10.85	10	63	36.5
Bangladesh	1994–2004	9	26.5	83	82	82.5
Cambodia	2000–2004	2	34		64	64
PRC	1989–2000	5	82.9	99	93	96
India	1993–2001	6	50.1	89	95	92
Indonesia	1991–2004	11	29.08	92	87	89.5
Kazakhstan	1995–1999	3	88.66	97	97	97
Lao PDR	2000–2003	2	44.3		79	79
Malaysia	2003	1	98	100	100	100
Maldives	1996–2001	2	76.55	100	98	99
Mongolia	1996–2000	3	45.5	87	87	87
Myanmar	1995–2003	5	16.88	86	80	83
Nepal	1991–2004	7	48.57	95	96	95.5
Pakistan	1991–2003	9	54.41	95	96	95.5
PNG	1996	1	60.5	88	88	88
Philippines	1993–2003	4	49.5	95	87	91
Solomon Islands	1990	1	76		94	94
Sri Lanka	1987–2004	3	34.33	91	98	94.5
Thailand	1987–2000	3	73.03	98	98	98
Vanuatu	1989–1998	2	77.95	93	86	89.5
Viet Nam	1996–2002	5	55.6	90	99	94.5

Table 11: Rural House Connections and Overall Access Rates for Water

Country	*Years*	*Number of Years*	*House connections (%)*	*Access 1990*	*Access 2004*	*Average*
Afghanistan	1997–2003	2	0	3	31	17
Bangladesh	1994–2004	8	0.23	69	72	70.5
Cambodia	2000–2004	2	1.5		35	35
PRC	1989–2000	5	44.1	59	67	63
India	1993–2001	6	8.28	64	83	73.5
Indonesia	1991–2004	11	4.41	63	69	66
Kazakhstan	1995–1999	3	27	73	73	73
Lao PDR	2000–2003	2	5.85		43	43
Malaysia	2003	1	87	96	96	96
Maldives	1996–2001	2	0.1	95	76	85.5
Mongolia	1996–2000	3	0.96	30	30	30
Myanmar	1995–2003	5	1.62	47	77	62
Nepal	1991–2004	7	8.28	67	89	78
Pakistan	1991–2003	9	12.94	78	89	83.5
PNG	1996	1	3.6	32	32	32
Philippines	1993–2003	4	15.5	80	82	81
Sri Lanka	1987–2004	3	3.76	62	74	68
Thailand	1987–2000	3	11.93	94	100	97
Vanuatu	1989–1998	2	27.85	53	52	52.5
Viet Nam	1996–2002	5	2.22	59	80	69.5

Table 12: Urban House Connections and Overall Access Rates for Sanitation

Country	*Years*	*Number of Years*	*House connections (%)*	*Access 1990*	*Access 2004*	*Average*
Afghanistan	1990–2003	2	6.1	7	49	28
Bangladesh	1994–2004	6	9.26	55	51	53
Cambodia	2000	1	19.2		53	26.5
PRC	1989–2000	7	37.64	64	69	66.5
Cook Islands	1990	1	0	100	100	100
India	1993–2003	7	27.04	45	54	49.5
Indonesia	1998	1	1.8	65	73	69
Kazakhstan	1996–2003	2	74	87	87	87
Lao PDR	2000–2003	2	2.5		67	67
Malaysia	2003	1	41	95	95	95
Maldives	2001	1	99.4	100	100	100
Myanmar	1997–2003	4	5.9	48	88	68
Nepal	1991–2003	5	14.6	48	62	55
Pakistan	1991–2003	7	42.45	82	92	87
Palau	1990	1	56	76	96	86
PNG	1990	1	15	67	67	67
Philippines	1993–2003	4	4.75	66	80	73
Solomon Islands	1990	1	22	98	98	98
Sri Lanka	1999	1	3.6	89	98	93.5
Thailand	1999	1	0	95	98	96.5
Viet Nam	1996–2002	4	8.47	58	92	75

Table 13: Urban House Connections and Overall Access Rates for Sanitation

Country	*Years*	*Number of Years*	*House connections (%)*	*Access 1990*	*Access 2004*	*Average*
Afghanistan	2003	1	0.4	2	29	15.5
Bangladesh	2003	1	0.3	12	35	23.5
Cambodia	2000	1	0.1		8	4
PRC	1992–2000	7	2.08	7	28	17.5
India	1993–2003	7	1.97	3	22	12.5
Indonesia	1998	1	0	37	40	38.5
Kazakhstan	1996	1	4	52	52	52
Lao PDR	2000–2003	2	0.1		20	20
Malaysia	2003	1	12		93	93
Maldives	1999	1	17.9		42	42
Myanmar	1997–2003	4	0.4	16	72	44
Nepal	1991–2003	5	0.6	7	30	18.5
Pakistan	1991–2003	7	5.1	17	41	29
Philippines	1993–2003	4	1.25	48	59	53.5
Sri Lanka	1999	1	0	64	89	76.5
Thailand	1999	1	0	74	99	86.5
Viet Nam	1996–2002	4	0	30	50	40

Asian Water Development Outlook (AWDO) 2007

AWDO is a new publication commissioned by the Asian Development Bank (ADB) in view of the increasing importance of water in the future development scenarios of the Asia and Pacific region. In recent years, water has steadily gravitated toward the top of the national agendas of ADB's developing member countries. This is a desirable development because water is an essential requirement for human and ecosystems survival. In addition, water is a critical component for most development needs. Without adequate quantity and quality of water, it will not be possible to ensure food, energy, or environmental security of nations.

AWDO is aimed at Asian and Pacific leaders and policy makers and those interested in understanding the complexities and dimensions of the current and the future water problems, and how these can be addressed successfully in policy terms. Its main objective is to raise awareness of water-related issues and to stimulate an informed debate on how best to manage Asia's water future. These are important and complex issues, and their timely management can contribute to the achievement of all the water-associated Millennium Development Goals and beyond.

AWDO 2007 is ADB's first attempt to make a forward-looking assessment of the possible water future for the most populous region of the world. It is now increasingly being recognized that water is likely to be a major critical resource issue of the world, and that the social, economic, and environmental future of Asia is likely to depend on how efficiently and equitably this resource will be managed in the coming years.

About the Asian Development Bank

ADB aims to improve the welfare of the people in the Asia and Pacific region, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world's poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe. ADB's vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life.

ADB's main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB's annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB's headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

About the Asia-Pacific Water Forum

The Asia-Pacific Water Forum (APWF) provides countries and organisations in the region with a common platform and voice to accelerate the process of effective integration of water resource management into the socioeconomic development process of Asia and the Pacific. The APWF is an independent, not-for-profit, non-partisan, non-political network.

The APWF's goal is to contribute to sustainable water management in order to achieve the targets of the MDGs in Asia and the Pacific by capitalizing on the region's diversity and rich history of experience in dealing with water as a fundamental part of human existence. Specifically, the APWF seeks to champion efforts aimed at boosting investments, building capacity, and enhancing cooperation in the water sector at the regional level and beyond.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/water

Asia-Pacific Water Forum
Secretariat: Japan Water Forum (JWF)
6th FI,1-8-1 Kojima Chiyoda-ku
Tokyo, Japan APAN 102-0083
Tel +81 3 5212 1645
Fax +81 3 5212 1649
office@apwf.org
www.apwf.org/