

Dams: Cornucopia or Disaster?

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ABSTRACT *The current debate on dams has become dogmatic, emotional, and somewhat counter-productive. There is no one single solution that would be valid for a heterogeneous world, with differing climatic, physical, social, economic and environmental conditions; varying institutional, technical and management capacities; dissimilar institutional and legal frameworks for managing water; and divergent levels of development and available technology. No single paradigm can be equally valid for all these differing conditions, and this includes dams. What is needed is a systematic approach, where the main objectives of water developments are first identified, i.e., poverty alleviation, regional income redistribution, economic efficiency and environmental conservation. The best alternative available to achieve these objectives for the area in question should then be sought. The best solution may or may not include dams. In the field of water development, small is not always beautiful and big is not always magnificent. Solutions must be case-specific, and they could vary from one location to another, and even at the same location over time. Solutions may include construction of dams, large, medium or small, and/or other alternatives such as rainwater harvesting and groundwater recharge. There cannot be one, single, dogmatic, a priori answer of dams or no dams, in terms of optimal water resources development, which will suit all the different conditions of all the countries of this world, either at present, or for decades to come.*

Introduction

Construction of large dams has been a controversial issue in recent years. Proponents of large dams claim that they deliver many benefits, among which are: increased water availability for domestic and industrial purposes; increased agricultural production because of the availability of reliable irrigation water; protection from floods and droughts; generation of hydroelectric power; navigation; and overall regional development which improves the quality of life of the people, including women. They argue that like any other large infrastructure development or national policy, dams have both benefits and costs. However, the overall benefits of dams far outweigh their total costs, and thus society as a whole is far better off with dams.

In contrast, opponents argue that dams bring catastrophic losses to society, and that these societal and environmental costs far outweigh any benefits to which they may contribute. They claim that dams accentuate unequal income distributions since benefits go exclusively to the rich, while the poor slide further

down the economic ladder. Further, they claim that the main beneficiaries of dams are construction companies, consulting engineers, corrupt politicians and government officials, who work in tandem to promote them. The poor do not benefit from the dam 'gravy train': they mostly suffer because of it.

Why This Controversy?

The views of the proponents and opponents of dams have been polar opposites. Scientifically and logically both views cannot be correct.

There has never been a real dialogue between the two camps, especially on a continuing basis. For example, during the Second World Water Forum, the pro-dam sessions discussed the benefits of dams, and the anti-dam sessions blamed all societal ills on them. The proponents and opponents mostly did not attend each other's sessions. Both camps went home thinking that the Forum basically agreed with their views! The situation was a little better at the Third World Water Forum in Kyoto, where the International Hydropower Association (IHA, a pro-dam professional association) and the International Rivers Network (IRN, a totally anti-dam organization) arranged a debate on the benefits and costs of large dams. By all accounts the pro-dam group won this debate hands down, primarily because one of the two debaters fielded by IHA, Dr Cecilia Tortajada, focused her presentation on the benefits and costs of the Ataturk Dam, based on observed facts and scientific analyses, and not on polemics or hypothesis. In contrast, the IRN's generalized innuendos were extensively attacked by the audience for being highly 'economical' with the truth. However, this type of interaction between the two opposing camps has been very rare. Such discussions and debates are to be encouraged, since only through such debates, can a societal consensus on this complex issue be reached.

An important question that needs to be asked is why in the 21st century, with major advances in science and technology, it is not possible to answer the comparatively simple question of what are the real costs and benefits of dams in order that their net impacts and beneficiaries can be determined authoritatively and comprehensively? The sterile debate on dams needs to be resolved conclusively once and for all so that appropriate water development policies can be formulated and implemented, especially in developing countries so as to maximize their overall social welfare. *Prima facie*, it should not be a difficult question to answer.

However, the world of development is complex: with scientific uncertainties, regional variations, vested interests, dogmatic views and hidden agendas. The issue of dams is no exception and not surprisingly, it has fallen victim to this complex interaction of forces.

First a caveat. Neither this author nor the Third World Centre for Water Management makes a living either in promoting or opposing dams. Activities of the Centre that can be remotely considered to be dam-related, have never exceeded 10% of its budget; mostly they are around 5%. Thus, even if all the dam-related activities of the Centre were to disappear, this would have no material impact on its work.

There are many reasons which have fuelled the current controversy, some of which are real but others are artificial and manufactured. The main reasons for this controversy will be briefly discussed in the next section.

Vested Interests

There is no question that there are many people with a vested interest in this debate, irrespective of which side they are on. Much has been written and said about the construction and consulting companies associated with the planning, design and construction of dams, and their financial contributions to political parties, who are the final arbiters of making decisions in democratic societies. There is also no question that the construction and development of large dams is a capital-intensive activity, and many people benefit economically from this process. The dam lobby is often portrayed by the anti-dam lobby as being 'fat cats', who are interested in the construction of dams because of the financial benefits they obtain from their planning and construction processes. Unfortunately, the voices of many sections of society who benefit from dams, such as farmers and other sectors who use the hydropower generated from the dams, are seldom heard in this debate.

In contrast, those NGOs that are against dams (there are numerous pro-dam NGOs as well, but they are generally not as media-savvy as the anti-dam NGOs, and thus not as visible) mostly like to portray themselves as little 'Davids' who are pitted against the well-heeled 'Goliaths' of the pro-dam lobby, who they claim are highly connected to the corridors of power. There is no question that there are many grassroots NGOs, who have made a real contribution in bringing to public attention the plights of the people who have to be properly resettled due to the construction of large development projects (dams, new towns, airports, highways, etc.) However, many of the main activist NGOs in the anti-dam lobby have now become financially powerful, mainly with support from several international organizations, primarily from the United States. Their self-portrayal as little 'Davids' is more for media and publicity purposes. Some of them have already become Goliaths, thus making the fight between Goliaths and Goliaths.

In the past, involuntary resettlement was seen as a 'price of progress', and the people who had to be resettled were not properly compensated for their forced relocation. By making the plight of these displaced people a major political issue, the activist NGOs have played a very important role which needs to be acknowledged.

The current clout of NGOs can be realized from recent research by the Johns Hopkins Center for Civil Society (1999). It indicates that globally the non-profit sector has now become a \$1.1 trillion industry, employing some 19 million fully paid employees. This already represents the world's eighth largest economy (this estimate does not include religious organizations). As a global assessment of NGOs, carried out by a reputable NGO, SustainAbility (2003), has pointed out, the NGOs "that once largely opposed—and operated outside—the system [are] becoming integral to the system". They are not small anymore.

The international activist anti-dam NGOs are at present no exception to the above findings. They have become adept at playing the system to promote their own agendas, at least in terms of obtaining funds from the funding institutions, and generating extensive media publicity for their causes. In fact, as far as media publicity is concerned, the situation is exactly the reverse: anti-dam activists have become the 'Goliaths' compared to 'Davids' of the pro-dam lobby. In other words, in terms of the media, the tables have been totally turned round in approximately a decade.

The anti-dam lobby has also become financially powerful. Anecdotal evidence can confirm this fact. The only institution from the pro-dam or the anti-dam lobby that participated in the Third World Water Forum in Kyoto, in March 2003, and brought its own fully-fledged camera team was an NGO belonging to the anti-dam lobby. In fact, it should be noted that the pro-dam and the international anti-dam lobby are now both well financed: members of both the groups are now gold cardholders of frequent fliers clubs of major airlines!

There is no question that there are extremists in both the pro-dam and the anti-dam lobbies, who have their own vested interests and hidden agendas, and thus their views and statements need to be carefully analyzed in terms of their accuracies, generalizations based on limited or no facts, and innuendos. Truth has often become a casualty in this bitter fight.

Complex Issues with No Single Answer

The sweeping generalizations of the two groups mostly do not survive scrutiny. In the cacophony of arguments, what is often forgotten is that the issues involved are complex, and there is no single answer that could cover all the dams of the world, constructed or proposed, irrespective of their locations and qualities. Nor can one view be everlasting in any country: it could change with time.

What has been forgotten in the current debate on dams is that neither of the statements "all dams are good", nor "all dams are bad and thus no new ones should be constructed" is correct. Depending upon the criteria of 'goodness' selected, it has to be admitted that there are both good and bad dams. Furthermore, their needs vary from one country to another, and often from one region to another, especially within large countries such as Brazil, China or India, depending upon climatic, economic, social and environmental conditions. Furthermore, countries are at different stages of economic development, and thus their needs for dams also vary, depending upon their stages of development. In addition, an industrialized country such as the United States has mostly developed nearly all of its best and most economic dam sites. In contrast, much of the potential in sub-Saharan Africa (with the exception of South Africa) has yet to be tapped. Equally, some countries, such as Nepal, have similar levels of hydropower potential as that already developed by the USA. However, Nepal has developed only about 4% of its hydro potential. Thus, what may appear to be a logical and efficient solution for the USA at the present time in this issue is unlikely to be the best and the most suitable for the Nepalese conditions. With the subject of dams, as in most other complex development-related issues, there

is simply not 'one size that fits all'. Both the proponents and opponents of the dam debate have ignored this simple fact.

Climatic Differences

A major technical issue that has been totally ignored in the current debate is the very significant climatic differences between developed and developing countries, especially in terms of distribution of rainfall over the year. This is an important issue, because storage is more important for developing countries, compared to developed countries.

Very few development experts, including water experts, have appreciated the importance and relevance of climate patterns for economic development. This lack of understanding is especially difficult to understand in the case of the water experts, since one of their main concerns is precipitation. Even as early as 1951, Galbraith, an eminent economist, noted that if "one marks off a belt a couple of thousand miles in width encircling the earth at the equator, one finds within it no developed countries". A decade later, a United Nations report (1961, quoted in Biswas, 1984, p. 6) noted that if the industrialized countries are marked on a map, they will be seen to be located in the temperate zone. In other words, developed countries are located in temperate zones, but developing countries are found in tropical and sub-tropical climates (Biswas, 1984).

Another important issue that has received scant attention is the distribution of rainfall in the tropics and semi-tropics compared to the temperate zones. The annual rainfall averages mask the very significant differences in the distribution of rainfall patterns between developed and developing countries.

If the annual average rainfalls are compared between three cities, two in developing countries (Sokoto on the Southern border of the Sahel in Nigeria and Delhi, India) and London, England, they are somewhat similar: 57 cm, 71 cm and 67 cm respectively. However, if their distributions over the year are considered, the patterns are totally different. For example, London, a temperate zone city, can be characterized by a low but reasonably uniform monthly rainfall rate over the year, varying from a high of 61 mm in October to a minimum of 35 mm in April. Similarly, rainfall retained in the soil is reasonably uniform.

However, the rainfall pattern is very different for Sokoto. Nearly 36% of annual average rainfall occurs only during the month of August. Over 92% of average rainfall occurs within the 4-month period of June–September. There is no rainfall during the five months of November to March, and very little in April and October (10 and 13 mm respectively). Not surprisingly, Sokoto has a significantly lower rainfall retention rate in the soil throughout the year, compared to London. In fact the highest rainfall retention rate in the soil in Sokoto (September) is 42% lower than the lowest retention rate in London that occurs in August. Thus, not only water management strategies for London and Sokoto have to be very different, even though their annual average rainfalls are somewhat similar, but also irrigation water requirements for crops are also very different. Sokoto cannot manage water without storage during the rainy months, so that it can then be released as required over the year during the dry months. In contrast, in climatic regimes such as London, with its more uniform precipi-

tation and high soil moisture retaining rates, the need for irrigation water is significantly lower.

Even the monthly rainfall figures may give a misleading comparison. For example, the average number of rainy days in New Delhi in a year is about 40. During the rainy days, rainfall does not occur uniformly over a period of 24 hours. It has been estimated that Delhi receives its annual rainfall in less than 80 hours, although these hours are not necessarily consecutive.

If the town with the highest rainfall in India, Cherrapunji, is considered, it receives its annual rainfall of 10 820 mm during the southwest monsoon, between June and August. This tremendous rainfall occurs in about 120 hours. Because this tremendous quantity of water cannot be properly stored, Cherrapunji, in spite of its very substantial rainfall, faces a water shortage problem during the dry months of the year.

Overall, India as a country receives its annual rainfall in less than 100 hours. Because of this very skewed pattern of distribution of rainfall, water management strategies in India have to be different from those of countries in temperate climates such as the UK, where the rainfall is significantly more regular and predictable.

Because of the very high seasonality of rainfall in developing countries such as India or Nigeria, the critical issue is how to store such massive quantities of rainfall over very short periods so that they can be used over the entire year. In addition, the fluctuations in annual rainfall are also high in such countries, which means that the incidences of floods and droughts are much more frequent than in the temperate zone areas. Thus, for countries of the developing world in the tropical and sub-tropical regions, what are needed are cost-effective, socially acceptable and environmentally sound solutions as to how best to store this high precipitation over a comparatively short period, so that the stored water can be used annually during the dry periods, and also inter-annually during droughts. Accordingly, the technical complexities of water management that the developing countries of the tropics and semi-tropics face are significantly more complex than in the developed countries of the temperate zones. This simple fact has been ignored in the current debate on dams.

Because of such climatic differences, developing countries must consider all alternatives available for storing water during the periods of intense rainfall so that these can be made available whenever they are needed to satisfy human requirements. The alternatives available to smooth out these wide inter- and intra-annual fluctuations in rainfall include dams (small, medium and large), groundwater recharge and storage, and rainwater harvesting.

The sad part of the current debate on dams is that it has become increasingly dogmatic and emotional. Many times it appears to be a debate between the deaf: participants may hear what their opponents are saying, but they do not listen. The alternatives are not either/or, as the current debate would have us believe, but rather what alternatives will work best, where, and under what conditions. The discussions should be focused on how best to provide the water requirements of all segments of the society in the most cost-effective, efficient and reliable way, on a long-term basis.

For the most part, the current debate on dams or no dams is an irrelevant one. What is needed is to assess the societal requirements for water, and then take

steps to meet them in a socially acceptable way in the best manner possible. Depending on the prevailing conditions of the location under consideration, the most efficient alternative may be the construction of a large dam, or rainwater harvesting, or a mixture of these two, and/or other solutions. There is simply not one dogmatic solution that would fit all climatic, physical, social, economic and environmental conditions, for all countries of the world and for all periods in history.

It should be realized that in the real world of water resources management, small may not always be beautiful: sometimes it could be ugly (Biswas & Tortajada, 2001). Equally, big could be sometimes magnificent, but on other occasions it could be a disaster. Each alternative should be judged on its own merit and within the context in which it is to be applied. Therefore, solutions must be found for specific conditions. Dogmatic solutions, irrespective of whether big or small, are simply not universally applicable. Once the right solution has been identified for the specific location in question, what is needed is that it be planned, designed, implemented and managed as efficiently, equitably and as quickly as possible.

Absence of Ex-post Assessment of Dams

A major reason why the current non-productive debate on dams has thrived is because of the absence of objective and in-depth ex-post analyses of the physical, economic, social and environmental impacts of large dams, 5, 10 or 15 years after their construction. At present, thousands of studies exist on environmental impact assessments (EIAs) of large dams, some of which are very good but others are not even worth the paper on which they are printed. It should be realized that all EIAs are invariably predictions, and until the dams become operational, their impacts (types, magnitudes and spatial and temporal distributions) are not certain, and thus remain in the realm of hypotheses. Even the very best assessment can perhaps forecast only about 70–75% of the actual impacts accurately in terms of time, space and magnitude. For an average EIA of a large dam, some 40–50% of its impacts (positive or negative) are not properly identified.

Impact assessments must include both positive and negative impacts, and not follow the present widely practised assessment of only negative impacts. Like any major policy programme of projects, large dams have both positive and negative impacts. What is needed is a two-pronged approach which will include identification and assessment of positive benefits and recommendations of measures which will maximize them, and assessment of the negative impacts and policy actions that should be taken to minimize them. Only such a comprehensive approach will ensure that the net benefits that will accrue to the society can be maximized. Exclusive consideration of negative impacts, as is widely practised at present, is a fundamentally flawed procedure, which will very seldom contribute to the maximization of overall benefits to any society. Such practices will only give information on part of the story, which will not provide a good, logical and scientific basis for decision-making. Yet, this is the custom that is widely practised and almost universally accepted at present, not only in the field of water but also for other development projects as well.

While thousands of studies are available on EIAs of large dams, which were prepared prior to their construction, assessment of actual impacts of large dams 5, 10 or 15 years after their construction, from anywhere in the world, can be counted on the fingers of one's hands, and still have some fingers left over. Some have now claimed that the World Commission on Dams (WCD) prepared numerous such assessments of large dams from different parts of the world. Regrettably, most of these analyses are superficial and often skewed to prove the dogmatic and one-sided views of the authors who prepared these studies. They can be considered to be neither objective nor comprehensive. It is possible that among these assessments, there are a few good case studies. Most unfortunately, however, no rigorous peer reviews of these case studies were ever carried out. Consequently, if there is some 'wheat' among the mostly 'chaff', it remains indeed very well-hidden. Based on those assessments carried out for the WCD of dams with which I am familiar, it has to be said that if one of my graduate students had carried out these studies, I would have instructed him/her to redo them again properly, objectively and comprehensively. Thus, the WCD case studies of the assessments of the real impacts of large dams from different parts of the world are of very limited use to the water and development professions, irrespective of the current rhetoric of their supporters.

Because of the current sad situation, the Third World Centre for Water Management has initiated a comprehensive impact assessment (positive and negative) of three large dams that have been operational for a minimum of 10 years. These are the Aswan High Dam in Egypt, Atatürk Dam in Turkey, and Bhakra Nangal Dam in India. This analysis will also include the perceptions of the people in the areas affected by the dams, both beneficiaries as well as those who had to pay some costs, i.e. people who had to be resettled. The results of these in-depth studies will start becoming available from late 2004. The data collected will be available for scrutiny by whoever who is interested, and the analyses are being based only on facts, and not on dogmas, biases or hypotheses.

World Commission on Dams

Much has been said and written on the World Commission on Dams. The views on the process and the report have ranged from fawning admiration to outright rejection. An objective assessment of the process and an assessment of the real impacts (positive and negative) of the WCD have yet to be made. However, some comments on the Commission itself will be appropriate here.

In terms of history, in April 1997, the World Bank and the World Conservation Union (IUCN) convened a meeting at the IUCN headquarters in Gland, Switzerland, ostensibly to discuss an internal World Bank review on large dams and the need for a more in-depth study. This review had concluded that "the finding that thirty-seven of the large dams in this review (seventy-four percent) are acceptable and potentially acceptable, suggests that, overall, most large dams were justified" (World Bank, 1996).

The participants at this meeting were arbitrarily chosen by the two sponsors. The only consideration appears to have been that the participants came from a diverse group of interests. However, why a specific person or institution was invited and not another from the same interest group still remains a complete

mystery. According to the list of participants available, 38 people attended this workshop, of which 12 (nearly one-third) represented the two sponsors alone.

This group unilaterally decided to establish an international commission to review the effectiveness of large dams and develop standards, criteria and guidelines. The group which was originally selected without much logic then became a self-appointed 'reference group', some members of the World Bank and IUCN formed an Interim Working Group (IWG). The result was the World Commission on Dams, whose 'mandate' according to its own pronouncement was a report that would be submitted to the two sponsors, the reference group, and the 'international community', whatever this might mean.

The Commissioners and Chairman were selected by an opaque process. Why and on what criteria, each member was selected still remains a mystery. From the experience of this author, who has been associated with several World Commissions before, it is useful to compare the WCD process with two other earlier commissions, the Independent Commission on International Development Issues (the so-called Brandt Commission) and the World Commission on Environment and Development (the so-called Brundtland Commission).

The Brandt Commission owes its formation to the personal interest of Robert McNamara, the then President of the World Bank, and also at least had the moral backing of the United Nations. Unlike the WCD, this Commission did not pretend to be representative of all the stakeholders. Instead, it consisted of a group of very eminent persons from both the North and the South, and was chaired by a very well-known and well-respected international figure, former German Chancellor Willy Brandt of Germany, who was a household name. Individually, the members of this Commission were all well-respected international figures, who because of their own accomplishments in different areas, gave credibility and gravitas to the Brandt Commission, which the WCD sorely lacked.

The Brundtland Commission had an even better mandate compared to the Brandt Commission, since this initiative came directly from the Secretary-General of the United Nations, and the UN General Assembly unanimously adopted a resolution in 1983 to establish this Commission. It was chaired by the former Prime Minister of Norway, Gro Harlem Brundtland, an equally well-known development personality.

In retrospect, both these Commissions had very modest impacts on the global scene. It is important to view the WCD in an overall perspective of global development-related events of the last 25 years, especially because of the highly exaggerated claims that have been made on the effectiveness and impacts of the WCD by its supporters. Sadly, it was neither a unique exercise, nor a totally new initiative, but in fact a continuation of a well-established trend, but having a somewhat dubious origin.

There are some fundamental differences between the Commissions referred to above. Among these differences are the following:

- The Brandt and the Brundtland Commissions both had mandating authorities, the Brundtland more than the Brandt. In contrast, the WCD had a mandate, but there was no mandating authority. It was basically only 26 individuals

(not counting the World Bank and the IUCN staff members) who took upon themselves to start a Commission. Some of the participants later decided not to become actively involved with the Commission itself. Because the WCD had no mandating authority, its recommendations have not been binding to any party. Even one of its main godfathers, the World Bank, after initially making positive comments on the WCD process, now seems to have very little interest in changing its policies to reflect the recommendations of the WCD report.

- Irrespective of claims by the WCD itself, and also by its supporters, that the process used was transparent, democratic and unique, my limited interactions with the Secretariat were to the contrary: it was somewhat opaque, secretive and autocratic.
- The legitimate question that has not been asked so far, let alone answered, is who or what gave the arbitrarily selected 26 people and 12 staff members of the World Bank and the IUCN who were present at the Gland meeting, the right to set up an international commission, and give them an 'international' mandate? How, by whom, and through what processes was the WCD made representative so that it earned the right to speak for all the stakeholders?
- Under any logical criteria, the WCD was not a truly representative body of its stakeholders, irrespective of claims to the contrary. For example, the WCD had NGOs who were speaking in the name of indigenous and poor people who would be displaced due to the construction of the dams. However, it was never even considered having NGOs representing farmers whose agricultural production would increase because of irrigation provided by the dams. As a general rule, the number of farmers who are affected by a dam is far higher than the number of people who are displaced. It is a strange concept of democracy, transparency and representation of all the stakeholders, when the largest stakeholder, deliberately or otherwise, is ignored, and not invited to the table to participate fully. Nor were the people who would receive an assured water supply, which they did not have previously, invited to this group. Presumably they are stakeholders as well. Democracy means consideration of pluralism, and pluralism cannot be one-sided, as was the case for the WCD.

Because the process used by the WCD was seriously flawed, not surprisingly its report has had very modest impacts, if any, thus far on the countries that are building dams, or on the international funding institutions financing them. The real question that has yet to be asked, let alone answered, is if the WCD had not been established, would the world have been any different now, or 10 years from now? My personal feeling is that it would not have mattered very much, one way or another.

Conclusions

The current controversy on dams is a dogmatic and emotional debate. To the extent that it brings new issues that need to be carefully considered and addressed, this debate should be welcomed. To the extent that it is a debate between vested interests, any progress because of this debate is likely to be

somewhat limited. It may even mostly be futile. The debate needs to be refocused. What is necessary to consider is the overall architecture of the water development system which will achieve the objectives that societies in developing countries desperately need: poverty alleviation, regional income redistribution and environmental conservation. Within this overall architecture, what is imperative is how best to supply the water needs of the society, cost-effectively, equitably and in a timely and environmentally-friendly manner. The world of development is complex, and there will always be many types of trade-offs due to a major policy, programme or project. These trade-offs should be considered objectively, accurately, honestly, sensitively and in a socially acceptable manner. Within such an overall framework, the best solution for water development must be sought for each specific case. This may warrant construction of a dam in a specific location, but it may equally require another solution. Until the local needs, conditions and requirements are carefully assessed and considered, a solution of dam or no dam should not be a priori imposed, especially by people who are external to the region.

In the final analysis, alternatives selected may require the construction of properly planned and designed dams, which could be large, medium or small, or rainwater harvesting, or any number of appropriate alternatives. The solutions selected must not be dogmatic, and should always reflect the needs of the areas under consideration. In terms of water development, it should be remembered that small is not always beautiful and big is not always magnificent. Solutions must be specifically designed to solve the problems encountered. The current emotional debate on dams is somewhat akin to a solution-in-search-of-a-problem approach, where the a priori solution becomes dams or no dams, depending upon the lobbies concerned. Such a process is scientifically unacceptable, socially disruptive and environmentally dangerous.

No single pattern of water development is the most appropriate for all the countries of the world at any specific point of history. Countries are at different stages of development, their economic and management capacities are not identical, climatic, physical and environmental conditions are often dissimilar, institutional and legal frameworks used for water management differ, and their social and cultural conditions vary very significantly. Thus, there is simply not one single path to water development, which could be blindly followed by all the countries of the world all the time.

In addition, the world is changing very fast, and with it water management concepts and practices must change as well. The world of water management is likely to change more during the next 20 years, compared to the past 2000 years. Thus, past experiences can only be of limited help in water management, especially as these changes, unlike in the past, will come from outside the water sector. Among these driving and overarching forces are concurrent rapid and extensive urbanization and ruralization in developing countries, accelerated globalization, advances in technology such as biotechnology and desalination, and the continuing communication and information revolution. All these and other associated changes will affect water management through myriads of pathways, some of which can be anticipated now but others of which are still most unpredictable and thus likely to be somewhat unexpected. In this vastly

changing complex world of water management, there should be no room for sterile debates on dam or no dam.

The main question facing the developing countries of Asia, Africa and Latin America is *not* whether large dams have an important role to play in the future, but rather how best we can plan, design and construct them where they are needed so that their performances in economic, social and environmental terms can be maximized and their adverse impacts can be minimized; and how we can simultaneously ensure that those who may have to pay the costs of their implementation are explicitly made their beneficiaries. It will not be an easy task to accomplish, but it is nevertheless an essential task that must be accomplished. One can only recall the salutary words of George Bernard Shaw:

Some men see the world as it is and never
ask why
I dream of things that never were and
ask why not.

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