

Chapter 1

Impacts of Large Dams: Issues, Opportunities and Constraints

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1.1 Introduction

For nearly 5,000 years, water-retaining structures have been built in different parts of the world to ensure water is available for domestic and agricultural purposes throughout the year. From time immemorial, human beings have settled in the fertile plains of major rivers like the Nile in Africa, Euphrates-Tigris in Mesopotamia, and the Indo-Gangetic plain in the Indian subcontinent. In these areas, floods and droughts had to be managed to reduce losses to human and cattle populations and also to limit economic damage. During the past two centuries, hundreds of millions of people lived around rivers, which necessitated control of these rivers to provide assured water supply for domestic, agricultural and industrial purposes and to reduce flood and drought damages. Thus, the building of dams has gained steady momentum. More recently, after the 1930s, water requirements increased exponentially in countries where there was significant immigration, such as Argentina, Australia, Brazil, Canada and the United States, to satisfy the needs of their expanding populations. Globally, with the passage of time, water control and assured availability of water of appropriate quality became essential requirements for continuing economic and social development.

As human knowledge and experience advanced, it was possible to construct progressively larger and more complex water storage and distribution structures than ever before, especially towards the second half of the last century. Fortunately, these advances coincided with the rapid growth in global population during the post-1950 period, when more and more water was necessary to support ever-increasing human activities in the domestic, agricultural and industrial sectors. With very significant

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advances in technology, the human knowledge base and the global economy, and plentiful availability of water, it was possible to match the accelerating water demand by increasing its available supply in most countries till about 1990.

In addition, electricity requirements to support economic expansion and an ever-increasing global population have been rising in recent years, at a much higher rate than the water available. Since no large-scale generation of electricity is possible without water, water requirements for power generation have increased concomitantly. Furthermore, water-based transportation became over time an important means to move goods produced in one country to another where they were needed. Populations became progressively more dispersed over larger areas, and the rates of urbanisation increased. As a consequence, social settlements had to be protected from the ravages of regular droughts and floods through the construction of water control structures and better management practices. Water therefore became a critical component of development across the world for the nineteenth century as well as the first half of the twentieth century. This situation is still valid for most developing countries today.

A natural result of these and other related developments was that a large number of dams had to be built to satisfy the growing demands for, and control of, water for various purposes, including generating hydroelectricity to meet the burgeoning energy demands of the domestic, industrial and agricultural sectors. Hydropower became an important source of energy, so much so that in a country like Canada, the word 'hydro' became synonymous with electricity. From the 1930s to the 1980s, numerous dams were built all over the world for hydropower generation, flood control or multi-purpose water development.

1.2 Developments During the Post-1950 Period

Construction of large dams before the 1960s was very significant in the so-called developed world, which included western Europe, the United States, Australia, Canada, the former Soviet Union and Japan. Institutions such as the Bureau of Reclamation and the Corps of Engineers of the United States became famous all over the world because of their expertise in constructing and managing large dams to promote economic development and sustain human welfare. The Tennessee Valley Authority (TVA) of the United States was viewed with admiration worldwide for a considerable time after the 1940s because of its positive impacts on regional economic development. Also during this period, the TVA was generally seen through rose-coloured glasses and while its benefits were the subject of adulation, its weaknesses were not considered seriously, either within the United States or in the rest of the world. A few countries such as India tried to duplicate the TVA experience with its Damodar Valley Corporation (DVC). Not surprisingly, the DVC model did not work out too well for India, because of problems arising from technology transfer between two countries with significantly different physical, technical, social, cultural, economic and institutional conditions, and also because times

and perceptions had changed in the intervening period between the establishments of the TVA and of the DVC. Similarly, the Murray-Darling Basin development in Australia was initially considered to be a successful project, only to be discarded as a development model in the post-2000 era when prolonged drought ravaged Australia. In other words, the models that were considered to be very good when they were first planned and constructed were later found to have many disadvantages. This is not only true in the area of dams development but also in other areas of development.

During the post-1950 period, many countries of Asia and Africa began to shed their colonial past. With their newly gained independence, there was an urgency to accelerate their national development processes, to which inadequate attention had been paid by colonisers during centuries of European rule. Accelerated social and economic development became an urgent necessity in all these countries to improve the standard of living of their people. Water was considered to be an important means to foster such development processes. Because of the major contributions dams could make to national development processes, construction of large dams often became a symbol of nation-building and national pride, and in many instances was considered to have contributed to national unity. Thus, the first Prime Minister of India, Jawaharlal Nehru, said that large dams were the new temples of modern India. Not surprisingly, the Bhakra and Hirakud dams in India, Volta Dam in Ghana, Kariba Dam in Zambia, and the High Aswan Dam in Egypt were all considered to be symbols of development and progress in these newly independent countries. It is also clear that these dams helped their national economies in a myriad of ways, many of which are still not fully known or understood. Eminent leaders of the time, such as President Gamal Abdel Nasser of Egypt and Prime Minister Kwame Nkrumah of Ghana, viewed these large structures as indicators of shedding the colonial past, and of postcolonial development. (Biswas and Tortajada 2002).

By 1975, the United States, Canada and most countries in Western Europe had essentially completed their programmes of constructing large dams. In addition, by this time the best and the more economic sites had been developed in these advanced countries. Of course, the situation was very different in the developing world, where much of the large water infrastructures could not be built for a variety of reasons. Thus, during the post-1975 period, the construction of large dams rarely occurred in the developed countries mentioned above; the focus shifted completely to developing countries such as Brazil, China, India, Indonesia, Malaysia, Thailand, Turkey, etc., where earlier progress had been insufficient. Japan is one of the very few developed countries where large dams continued to be built during the post-1975 period.

1.3 Developments During the Post-1975 Period

A major development of the period after 1975 was the gradual emergence of environmental and social movements, initially in a few select developed countries. Their environmental advocacy steadily contributed to major changes in people's mindsets.

In June 1972, in Stockholm, the United Nations convened the first of its large conferences of the decade on the human environment. This conference was a landmark for the environmental movement, even though it was boycotted by the then Soviet Union and the countries of Eastern Europe over political issues related to the status of East Germany. This conference was followed in rapid succession by similar UN mega-conferences on population (Bucharest, 1974), food (Rome, 1974), women (Mexico City, 1975), human settlements (Vancouver, 1976), water (Mar del Plata, 1977), desertification (Nairobi, 1977), science and technology for development (Vienna, 1979) and new and renewable sources of energy (Nairobi, 1981). All these conferences did include some discussions on water, and all of them also considered the environment in one form or another (Biswas and Tortajada 2009). The Stockholm Conference also resulted in the establishment of the United Nations Environment Programme. It was the first UN agency that was established in a developing country, and was expected to represent the environmental consciousness of the UN system. All these events cumulatively, and in their own ways, have had a considerable impact on the way social perceptions of large dams have evolved in one form or another.

When the Stockholm Conference was held in 1972, few countries had ministries concerned with the environment. Now, some 38 years later, it is difficult to find a single important nation that does not have an environment ministry or department. The environment has now rightly become a mainstream subject, and environmental impact assessments of large development projects have become mandatory in nearly all countries of the world.

While ensuring that environmental issues are properly considered in all development projects has been a most welcome improvement, it must also be admitted that projects to improve or maintain environmental conditions and people's quality of life in the developing world are now often prevented or delayed due to some vocal activists working on a single cause whose main objective is to prevent construction of all types of infrastructures irrespective of their overall benefits to society. These so-called environmentalists, who are primarily from the developed world, have exercised considerable power directly and through financial and intellectual support to their counterparts in the developing world. Many of these activists from the developed world, who already have a good standard of life, access to clean water, adequate food and energy, and a very good lifestyle, have often eschewed scientific and technical facts, manipulated available information, quoted data and information that are patently erroneous or out of context and always had their own hidden agendas.

For reasons that remain difficult to fathom, the construction of large dams became a lightning rod for many of these so-called environmental activist groups in recent years. In an era of 'small is beautiful', large was automatically deemed bad and ugly on ideological grounds, irrespective of desirability or benefits. Accordingly, and not surprisingly, a myth began to emerge that all large dams are bad, and also that the water problems of the developing world could be successfully and cost-effectively resolved in a timely manner only through small dams or rainwater harvesting structures.

There is no doubt that small dams and water harvesting techniques will help in some rural and smaller urban areas. Thus, given their technological, economic and socio-environmental desirability, their use in appropriate areas needs to be encouraged.

At the same time, however, it is important to recognise that small water structures alone will not be able to solve the complex water problems of large urban areas and major industries where demand for water is extremely high, and increasing, and where rainfall is scanty and erratic. Large and medium dams will be essential to continue to provide water for meeting the escalating needs of a steadily urbanising world for decades to come. Further, if future climatic regimes change, and/or climatic fluctuations intensify as compared to the present, countries will have to store more and more water to assure water security. This will require the construction of additional reservoirs, as well as more efficient use of stored water.

People in the western world have to realise that small dams alone cannot solve the water problems of the developing world. The same situation prevailed earlier in their own countries, where large dams had to be built to satisfy increasing water requirements. Having completed the construction of necessary large dams in the west, they are often opposed to the construction of large dams in the developing world, where social and economic needs for water-related activities are growing exponentially. It has to be realised that small can be beautiful, but under many conditions it could be inadequate or even ugly. Equally, big could be magnificent, but in a different context, it could also be bad and undesirable.

Whether a small or large dam is the most appropriate solution depends on many specific local conditions. Thus, what is desirable at this point is not a dogmatic and irrational debate between small and large dams, since both are necessary, but rather a judicious mixture of small and large dams which could solve the water problems of the developing world, and could simultaneously contribute to improvements in the quality of life of citizens. The decision regarding the most appropriate balance has to be made by the people of each developing country themselves, based on their own requirements and aspirations, and physical, social, economic, cultural and environmental conditions.

More specifically, these decisions must be made by those living in the river basins where development projects are being considered, and which may affect their future lifestyles positively and/or negatively. In the present era, where democracy is considered essential, these complex decisions must be made after a serious and informed debate, primarily among the people in areas where development is being contemplated. Thus, the decision whether or not to construct a large dam in a specific state in Brazil, India or China should be made by the people of that area, and must not be imposed on them by activists from the United States or Western Europe, irrespective of their motives, dogmatic beliefs and hidden agendas, as a form of neocolonialism. Nor should decisions be dictated by urban elites who are not from the region where such projects are being considered. People from outside the region can make a contribution to the debate, but they should not be allowed to manipulate the process so that their dogmatic views, whatever they may be, prevail in the end, unless that is also what the local people want. Sadly, this does not happen in many cases, and people from outside the development areas, and also from outside the countries, are influencing decisions because of their economic power and media influence. Such decisions are often detrimental to the people of the developing countries on a long-term basis.

1.4 Controversy During the Post-1985 Period

The construction of large dams became an even more controversial issue than ever before, especially after 1985. Proponents of large dams claim that they deliver many benefits, among which are increased and assured 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, particularly women. They argue that like any other large infrastructure development or national policy, dams have both benefits and costs. However, properly planned and constructed, the overall benefits of dams far outweigh their total costs, and thus society as a whole is better off with such well-planned dams. It should be noted that at present there is enough knowledge, experience and technology to plan, construct and manage new large dams properly.

In contrast, opponents argue that dams bring catastrophic losses to society, and the social and environmental costs far outweigh any benefits that dams may contribute. They claim that dams accentuate unequal income distribution since benefits accrue almost exclusively to the rich, while the poor slide further down the economic ladder. They also claim that the main beneficiaries of dams are construction companies, consulting engineers and corrupt politicians and government officials, who work in tandem to promote such dams. They argue that the poor do not benefit, instead they mostly suffer because of these structures.

1.4.1 Why This Controversy?

In recent years, the views of proponents and opponents of large dams have become polarised. In scientific and logical terms, 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, held in The Hague in 2000, the pro-dam sessions discussed the benefits of dams, and the anti-dam sessions blamed all the ills of society on them. For the most part, proponents and opponents did not attend each other's sessions. Both sides went home thinking that the Forum basically endorsed their views as correct!

The situation was a little better at the Third World Water Forum in Kyoto, where the International Hydropower Association (IHA, a professional association promoting well-planned hydro development) and the then International Rivers Network (IRN, a non-governmental organisation whose sole *raison d'être* is to oppose the construction of all dams) arranged a debate on the benefits and the costs of large dams. By all accounts, the pro-dam group won this debate with arguments based on observed facts and scientific analyses, and not on polemics or hypotheses. IHA's presentation focused exclusively on the benefits and costs of the Atatürk Dam, and drew on observed facts and figures which were meticulously collected. In contrast,

the IRN's generalised innuendos were extensively attacked by the audience for being one-sided, erroneous and highly economical with the truth. However, interactions of this kind between the two opposing camps have been very rare. Such discussions and debates should 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 twenty-first century, with major advances in science and technology, it has not been possible to answer the relatively simple question of the real costs and benefits of large dams, so that their net impacts and benefits 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, which will maximise their overall social and economic welfare. *Prima facie*, it should not be a difficult question to answer, scientifically and objectively. However, vested interests have stood against its resolution.

It should be noted that 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.

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

1.5 Vested Interests

There is no doubt that many people have a personal interest in this debate, irrespective of which side they are on. Much has been written and said about the construction and consulting companies that are associated with the planning, design and construction of large dams, and accusations have been made about their financial contributions to political parties, who are often the final arbiters and decision-makers in democratic societies. There is also no doubt that construction and development of large dams is a capital-intensive activity, and many people benefit economically from this process. The anti-dam lobby often portrays the pro-dam lobby as being interested in the construction of dams only because of the financial benefits obtained through the planning and construction processes. Unfortunately, the voices of people from varied sectors of society who benefit from dams, like farmers and others who use the hydropower generated by dams, are seldom heard in this debate.

In contrast, those non-governmental organisations (NGOs) which are against dams (there are numerous pro-dam NGOs as well, but they generally are not as media-savvy as the anti-dam NGOs, and are thus not as visible) mostly portray themselves as little 'Davids' who are pitted against the well-heeled 'Goliaths' of the pro-dam lobby, who have direct connections to the corridors of power. It is true that many grassroots NGOs have made useful contributions in highlighting the plight of people who have to be resettled as a result of large development projects (dams, new

towns, airports, highways and so on). However, many of the main activist-NGOs in the anti-dam lobby have now become financially powerful, mainly with support from several international funding agencies, primarily from the United States. Their self-portrayal as small or weak organisations is primarily aimed at the media and for publicity purposes, and is far from the truth.

The current power of NGOs can be surmised from some research by the Johns Hopkins University Centre for Civil Society (1999) which indicated that, globally, the non-profit sector (excluding religious organisations) has become a \$1.1 trillion industry, employing some 19 million fully paid employees. This represents the world's eighth largest economy. A global assessment of NGOs carried out by a reputable NGO, SustainAbility (2003: 2), has pointed out that NGOs 'that once largely opposed—and operated outside—the system' are becoming integral to the system. They are no longer small or even outsiders, as many would like to portray themselves. Nor are their motives and activities transparent, which is exactly what they accuse their opponents of.

International activist anti-dam NGOs are at present no exception to the findings mentioned above. They have become adept at playing the system to promote their own agendas, at least in terms of obtaining funds from various institutions, and generating extensive media publicity for their unitary causes. The anti-dam lobby has also become financially powerful. Anecdotal evidence can confirm this. For example, the only institution concerned with the debate on dams that participated in the Third World Water Forum in Kyoto and brought its own recording team was an NGO belonging to the anti-dam lobby.

There is no doubt 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 analysed for accuracy, generalisations based on limited or no facts, and innuendos. Truth has often become a casualty in this bitter fight between the two camps.

Sebastian Mallaby (2004a), columnist and editorial writer for *The Washington Post*, assessed two dam projects that have been consistently opposed by activists: a dam on the Nile at Bujagali, Uganda, and the Qinghai Project in Tibet, China. In a very detailed analysis of local opposition to the proposed large dam at Bujagali, Mallaby found that contrary to the extensive claims of a Californian anti-dam NGO, the people who are to be resettled are quite happy to accept the terms. The only people who objected to the dam were those living outside its perimeter since they would not benefit from its generous relocation payout.¹

Mallaby went on to argue that:

The story is a tragedy for Uganda. Clinics and factories are being deprived of electricity by Californians whose idea of an electricity crisis is a handful of summer blackouts. But it is also a tragedy for the fight against poverty worldwide, because projects in dozens of countries are similarly held up for fear of activist resistance. Time after time, feisty internet-enabled groups make scary claims about the inequities of development projects. Time after time, Western public raised on the stories of World Bank white elephants believe them.

(Mallaby 2004a: 52)

¹ On this issue, see also Mallaby (2004b).

He concluded that ‘NGOs claim to campaign on behalf of the poor, yet many of their campaigns harm the poor’ (Mallaby 2004a: 52). Based on our own experience from different parts of the world, we have to agree with Mallaby.

1.6 Complex Issues with No Single Answer

The sweeping generalisations of the two groups, made primarily to justify their positions, for the most part do not survive scrutiny. In the cacophony of arguments, what is often forgotten is that the issues involved are complex, and that there is no single answer that could apply to all the dams of the world, constructed or proposed, irrespective of their locations and sizes. Nor can one view be everlasting in any country: it will invariably change with time.

What has been forgotten in the current debate on dams is that neither the statement ‘all dams are good’ nor ‘all dams are bad and thus no new ones should be constructed’ are correct and applicable to all dams. Depending on the criteria of ‘good’ selected, it has to be admitted that there are both good and bad dams. Furthermore, the needs vary from one country to another, from one period to another and often from one region to another, especially within large countries such as Brazil, China or India, depending on climatic, economic, social and environmental conditions.

It is equally important to recognise that countries are at different stages of economic development, and thus their needs for dams also vary. Also, an industrialised country like the United States has developed nearly all of its best and most economic dam sites. In contrast, most potential sites in sub-Saharan Africa (with the exception of South Africa) have yet to be developed. A country like Nepal has a similar amount of hydropower potential as that already developed in the United States. However, Nepal has developed only about 4% of its hydro potential. Thus, what may appear to be a logical and efficient solution for the United States at present is unlikely to be the best and most suitable solution for conditions in Nepal.

There is a time dimension to these arguments as well. For example, during the 1960s, 1970s and 1980s, Asahi Shimbun, one of the newspapers with the largest circulation in Japan, routinely took the Japanese government to task for not building enough dams. This has changed dramatically in the past two decades—the same newspaper now routinely takes the government to task for building dams. From being a pro-dam newspaper, it has now become an anti-dam newspaper. Such changes in perception and attitude often happen over time.

In the area of dams, as in most other complex development-related issues, there simply is not ‘one size that fits all’. Each large dam is unique: it has its own sets of benefits and costs. In the final analysis the decision to construct a new dam should be based on its overall benefits to society. Both the proponents and opponents in the dam debate have ignored this simple fact.

1.7 Climatic Differences

A major scientific issue that has been totally ignored in the current debate are the very significant climatic differences between developed and developing countries, especially in terms of rainfall distribution across the year, and from one year to another. This is an important issue, because storage is more important for developing countries because of the rainfall patterns which are more erratic, compared to the developed countries of the temperate zones.

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 water experts, since one of their main concerns is precipitation. 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’ (Galbraith 1951: 693). The same year, a United Nations report (1951) noted that if the industrialised countries are marked on a map, it will be seen that they are located in the temperate zone. In other words, developed countries are located in temperate zones, but developing countries are found in tropical and subtropical climate areas (Biswas 1984).

Another important issue that has received scant attention is the distribution of rainfall in the tropics and subtropics compared with the temperate zones. The annual rainfall averages mask the very significant differences in the patterns of rainfall distribution between developed and developing countries. For example, if the annual average rainfalls of three cities are compared, two in developing countries (Sokoto on the southern border of the Sahel, in Nigeria, and New Delhi in India) and London, United Kingdom, they are somewhat similar: 57, 71 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 characterised by a low but reasonably uniform monthly rate of rainfall 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 across the year is reasonably uniform.

However, the rainfall pattern is very different for Sokoto. Nearly 36% of annual average rainfall occurs during the month of August alone. More than 92% of average rainfall occurs within the 4-month period of June to September. There is no rainfall during the 5 months of November to March, and very little in April and October (10 and 13 mm, respectively). Not surprisingly, Sokoto has a significantly lower rate of rainfall retention in the soil throughout the year, compared with London. In fact, the highest rainfall retention rate in the soil in Sokoto is 42% (September), which is lower than the lowest retention rate in London that occurs in August. Thus, water management strategies for London and Sokoto have to be very different, even though their annual average rainfalls are somewhat similar. Irrigation, the largest user of water in the world as a whole, has to be very different as well. Sokoto cannot manage year-long agricultural production without storing water during the rainy months, which can then be progressively released as required over the

year during the dry months. In contrast, in the case of climatic regimes like London with its more uniform precipitation and high soil moisture retention rates, the need for irrigation water is significantly lower. In fact, no irrigation is needed for high soil moisture retention rates as noted in London.

Even monthly rainfall figures may lead to a misleading comparison. For example, the average number of rainy days in New Delhi is about 40%. However, during the rainy days, rainfall does not occur uniformly over a period of 24 h. It has been estimated that New Delhi receives nearly 90% of its annual rainfall in less than 80 h, though these hours are not necessarily consecutive. One of the雨iest towns of India, Cherrapunji, receives much of its annual rainfall of 10,820 mm during the southwest monsoon, between June and August. This immense rainfall occurs mostly in about 120 h. Because this vast quantity of water cannot be properly stored, Cherrapunji, in spite of its very substantial rainfall, currently faces serious water problems during the dry months of the year.

Overall, India receives nearly most of its annual rainfall in less than 100 h. Because of this very skewed pattern of rainfall distribution, water management strategies in India have to be different as compared with countries in temperate climates where rainfall is significantly more regular and predictable.

Because of the very high seasonality of rainfall in most developing countries, the critical issue is the storage of such immense quantities of rainfall over very short periods, so that they can be used over the entire year. In addition, the inter-annual fluctuations in 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. Thus, what is needed for countries of the developing world in the tropical and subtropical regions are cost-effective, socially acceptable and environmentally sound solutions for storing large volumes of precipitation over a comparatively short period, so that the stored water can be used during the dry periods each year, and also inter-annually during prolonged periods of droughts. The technical complexities of water management in the developing countries of the tropics and subtropics are therefore significantly more complex than those in developed countries located in temperate zones. This simple fact has been totally ignored in the debate on large dams.

Because of climatic differences, developing countries must consider all possible alternatives available for storing water during the periods of intense rainfall, so that these can be made available whenever necessary to satisfy human needs. The alternatives to smoothen out these wide inter- and intra-annual fluctuations in rainfall may include dams (small, medium and large), groundwater recharge and storage, as well as rainwater harvesting. Water problems can only be resolved by taking such a holistic approach. None should a priori be excluded.

It is sad that the current debate on dams has become increasingly dogmatic and emotional. Participants may often hear what their opponents are saying, but they do not listen. The alternatives available are often not ‘either/or’ solutions; what is needed is the consideration of which alternatives will work best, where and under what conditions. The focus of discussions should be on how best to meet the water needs for all segments of society cost-effectively, efficiently and reliably, on a long-term basis.

For the most part, the current debate on ‘dams or no dams’ is an irrelevant one. It is far more important to objectively assess the societal needs for water, and then take steps to meet them in the best and the most socially, economically and environmentally acceptable way. Depending on the prevailing conditions of the location under consideration, the most efficient alternative may be the construction of a large dam, rainwater harvesting, a mixture of these two and/or other solutions. There is simply no single solution that will be appropriate for all climatic, physical, social, economic and environmental conditions, for all countries of the world and also for all periods in history.

In the real world of water resources management, small may not always be beautiful. By the same token, large could sometimes be magnificent, but on other occasions it could be a disaster. Each alternative must be judged on its own merit and within the context in which it is to be applied. Once the right solution has been identified for the specific location in question, the scheme should be planned, designed, implemented and managed as efficiently, equitably and quickly as possible.

It should also be noted that the economies of developed countries are at present no longer dependent on water or climatic fluctuations. Accordingly, if there are droughts and floods, these often result only in temporary inconvenience for some of the people but not serious long-term damage to the country as a whole. In contrast, availability of drinking water in developing countries often depends on rainfall because of lack of infrastructures and their poor operation and maintenance. Furthermore, agriculture continues to be a very important factor for survival in the developing world, in terms of both food and employment generation. Prolonged droughts also mean low reservoir levels, and thus lower hydropower generation. This often results in regular power cuts and voltage reductions, which seriously disrupt industrial production and contribute to a poorer quality of life of the people. Industrial production and employment suffers. Reduced agricultural production and the disruption of industrial activities as a result of power shortages contribute directly to serious human hardships. The absence of proper water management thus produces a ‘lose-lose’ situation all around. On the whole, developed countries are largely immune to this process at present. They may have been vulnerable some 50–100 years ago, but their economies are now significantly more diversified and resilient to successfully meet the current climatic vagaries. The situation may become more complex and difficult in the future, once the impacts of climate change on water management can be properly assessed.

1.8 Absence of Post-Construction Assessment of Dams

One of the major reasons why the current non-productive debate on dams has thrived is the absence of objective and detailed 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 while others are not worth

the paper on which they are written. It should be realised 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 accurately forecast only about 70–75% of identified impacts in terms of time, space and magnitude. It is not possible to identify 25–30% of the impacts that will actually occur after the dams have become operational. For an average EIA of a large dam, some 30–50% of its impacts (positive or negative) are not accurately identified at present, in terms of types, magnitude, spatial distribution and timings.

In addition, all environmental assessments must include both positive and negative impacts. A two-pronged approach is needed which will include identification and assessment of positive benefits and recommendations of measures which will maximise them, as well as an assessment of the negative impacts and policy actions that should be taken to minimise them. Only such a comprehensive approach can ensure that the net benefits to society can be maximised. Exclusive consideration of negative impacts while conducting EIA, as is widely practised at present, is a fundamentally flawed procedure, which will seldom contribute to the maximisation of overall benefits of any project. Such methods will yield information only on part of the story, and will not provide a sound, logical and scientific basis for making rational and long-term decisions.

As mentioned above, while thousands of EIAs were conducted for large dams prior to their construction, assessment of actual impacts of large dams 5, 10 or 15 years after their construction are very few and far between. Some have claimed that the World Commission on Dams (WCD) prepared numerous such assessments of large dams in different parts of the world. Unfortunately, most of these analyses are superficial and often skewed to prove the dogmatic and one-sided views of the authors who undertook the studies, the majority of whom belonged to the anti-dam lobby. These assessments can therefore neither be considered objective nor accurate. It is possible that among these highly biased assessments, there are a few good case studies. Unfortunately, however, no rigorous peer reviews of these case studies were ever carried out and as a consequence, any valuable cases among these reports, if they exist, remain very well hidden. The authors of five of these case studies submitted their papers for possible publication in the *International Journal of Water Resources Development*. All five papers were rejected for their poor quality by peer reviewers. Thus, the WCD case studies of assessments of the real impacts of large dams from different parts of the world are of very limited use to the water and development professional, irrespective of the current rhetoric of their supporters whose numbers are shrinking as time passes.

Because of this unfortunate current situation, the Third World Centre for Water Management carried out a comprehensive impact assessment (positive and negative) of three large dams that have been operational for a minimum of 10 years: the High Aswan Dam in Egypt, Atatürk Dam in Turkey, and the Bhakra-Nangal Project in India. This analysis also included the perceptions of people in areas affected by the dams, both beneficiaries as well as those who had to pay some costs, for example, people who had to be resettled. Two of these in-depth case studies, on the Bhakra-Nangal Project

(Rangachari 2006), and the High Aswan Dam (Biswas and Tortajada 2011) are now available. A comparison of these two comprehensive analyses with similar studies carried out by the WCD would likely show the superficial quality of the WCD studies and their inherent biases.

1.9 World Commission on Dams

Much has been said and written on the WCD. Views on the process and the report have ranged from admiration to outright dismay. 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 and its report would be appropriate here.

In April 1997, the World Bank and the International Union for Conservation of Nature (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 detailed study. This review concluded that ‘the finding that 37 of the large dams in this review (74%) are acceptable and potentially acceptable, suggests that, overall, most large dams were justified’ (World Bank 1996).

The two sponsors arbitrarily chose participants for this meeting. The only consideration appears to have been that the participants represented diverse groups of interests. However, the reasons why a specific person or institution and not another from the same interest group was selected remain a mystery. According to the list of participants available, 38 people attended this workshop, of which 12 (nearly a 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 an adequate rationale, subsequently became a self-appointed ‘reference group’. In addition, some members of the World Bank and IUCN unilaterally formed an Interim Working Group. The net result was the creation of a World Commission on Dams, the ‘mandate’ of which, according to its own pronouncement, was to develop a report that would be submitted to the two sponsors, the reference group, and the ‘international community’. What constituted the ‘international community’ was not spelt out.

The chairman and commissioners were selected through a completely opaque process. The criteria and reasons for selection are still unknown. Since one of the authors of this chapter has been associated with several world commissions before, it is useful to compare the WCD process with two earlier commissions, the Independent Commission on International Development Issues (the Brandt Commission) and the World Commission on Environment and Development (the Brundtland Commission).

The Brandt Commission owed its formation to the personal interest of Robert McNamara, then President of the World Bank, and it had the moral backing of the United Nations. Unlike the WCD, the Brandt Commission did not pretend to be representative of all stakeholders. It consisted of a group of eminent persons

from both the North and the South, and was chaired by a very well-known and highly regarded international figure, the former German Chancellor Willy Brandt. The individual members of this commission were also respected international figures who, because of their own accomplishments in various areas, brought credibility and gravitas to the Brandt Commission, which most of the WCD members 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. 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, also a well-known development personality. In retrospect, both these commissions had very modest long-term impacts in terms of the implementation of their recommendations on a global basis. This, unfortunately, has been the case for most of the world commissions.

It is important to view the WCD within an overall perspective of global development-related events of the past 25 years, especially because of the highly exaggerated claims made regarding its effectiveness and impacts by many supporters. Unfortunately, it was neither a unique exercise nor a totally new initiative, but in fact the continuation of a well-established trend. In addition, it had a somewhat dubious origin, which leads one to seriously question its legitimacy and objectivity.

There are some fundamental differences between the three commissions discussed above, among which are the following:

- The Brandt and the Brundtland commissions both had mandating authorities, the Brundtland more so than the Brandt. In contrast, while the WCD had a mandate there was no mandating authority. The WCD basically consisted of 26 individuals (excluding the World Bank and the IUCN staff members) who took it upon themselves to start a ‘World Commission’. Some participants later decided not to be actively associated with the commission itself. Because the WCD had no mandating authority, its recommendations have not been binding on any party. Even the World Bank, one of the two godfathers, made some initial positive comments on the WCD process but then showed very little interest in changing its policies to reflect the recommendations of the WCD report.
- Irrespective of the claims by the WCD and by its supporters that the process was transparent, democratic and unique, the authors’ interactions with the Secretariat suggested the contrary. It was somewhat opaque, secretive, autocratic and ad hoc.
- The legitimate question that has not been raised so far, and has certainly not been answered, is who or what gave the arbitrarily selected 26 persons, and the 12 staff members of the World Bank and the IUCN present at the Gland meeting, the right to set up an international commission, and give it an ‘international mandate’. How, by what authority, and through what processes was the WCD made representative so that it earned the right to speak for all stakeholders? In fact, many of the major stakeholders played absolutely no role in its deliberations and were also not considered for membership.
- According to 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 commissioners from the NGO community who spoke in the name of indigenous and tribal people who would be displaced as a result of dam construction. However, the commissioners were neither indigenous nor tribal. It is not clear who or what gave them the right to represent indigenous people; they were the self-appointed representatives of a large group. However, the WCD did not consider including NGOs that represented farmers, whose agricultural production would increase because of irrigation provided by 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 understanding of democracy, transparency and representation of all stakeholders, when the largest stakeholder, deliberately or otherwise, is not invited to participate. Nor did the WCD invite those who would receive assured water supply, which they earlier lacked. Democracy involves the consideration of pluralism, and pluralism cannot be one-sided as was the selection of commissioners by the WCD and as was reflected in its work.

Since the process employed by the WCD was seriously flawed, its report has had unsurprisingly modest impacts so far, if any, on the countries that are building dams, or on the international funding institutions that finance such projects. The real question that has yet to be asked, let alone answered, is: would the world have been any different, now or 10 years hence, if the WCD had not been established? The authors' view is that it would not have mattered very much one way or another!

1.10 Conclusions

The continuing controversy on dams is a dogmatic and emotional debate. To the extent that it raises new issues which need to be carefully considered and addressed, this debate should be welcomed. To the extent, however, that it is a debate between vested interests, any progress resulting from it is likely to be somewhat limited, or even futile. The debate needs to be refocused. What is necessary is to consider the overall architecture of the water development system that will fulfil the objectives and meet the needs of societies in developing countries: poverty alleviation, regional income redistribution and environmental protection. Within this overall framework, it is imperative to determine how best to supply the water needs of society, in a cost-effective, equitable, timely and environmentally friendly manner. The world of development is complex, and there will always be instances of trade-offs resulting from 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 architecture, the best solution for water development must be sought for each specific case. This may warrant construction of a large dam in a specific location, but it may just as well require a different solution, such as local rainwater harvesting, in another location. Until the site-specific needs, conditions and requirements have been carefully assessed and considered, a 'dam' or 'no dam' solution should not be imposed *a priori*, especially by people from outside the region.

In the final analysis, the 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 other appropriate options such as water conservation and the improvement of water-use efficiencies. The solutions selected must not be dogmatic, and should always reflect the needs of the areas under consideration. In terms of water development, it is important to remember that small is not always beautiful and large is not always magnificent. Solutions must be specifically designed to solve the problems at hand. The current emotional debate on dams is somewhat akin to a solution-in-search-of-a-problem, where the *a priori* solution becomes ‘dams’ or ‘no dams’, depending on the lobbies concerned and their vested interests. Such a process, if it is allowed to continue, may prove to be scientifically unacceptable, socially disruptive and environmentally dangerous, especially on a long-term basis.

No single pattern of water development is the most appropriate for all countries at any specific time, or even in the same country because of differing climatic, technical, economic, social or institutional conditions. Water development patterns will vary with time, knowledge and experience, as will development paradigms. Nothing is permanent. Countries are often at different stages of development. No two countries are identical. Their economic and management capacities are not identical; climatic, physical and environmental conditions are often dissimilar; institutional and legal frameworks for water management differ; and, social and cultural conditions vary significantly. Under these heterogeneous conditions that change with time, no single solution can be appropriate for all countries for all times.

In addition, the world is changing at a rapid pace, and its water management concepts and processes must change as well. Past experiences can only be of limited help in terms of water management, especially since these changes, unlike in the past, will come from forces external to the water sector. Among these driving and overarching forces are concurrent rapid and extensive urbanisation and ruralisation in developing countries, accelerated globalisation and free trade, advances in technology such as biotechnology and desalination, and a continuing communication and information revolution. All these and other associated changes will affect water management in a myriad ways, some of which can be anticipated at present while others are still mostly unpredictable and thus likely to be somewhat unexpected. In this vastly changing and 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 they can be planned, designed and constructed where they are needed so that their performance, in economic, social and environmental terms, can be maximised and their adverse impacts can be minimised. At the same time, it is necessary to ensure that those who may have to pay the costs of implementing dams (e.g. the people who have to be resettled) are made the direct beneficiaries of these projects. It will not be an easy task to accomplish, but it is nevertheless essential to make progress in that direction.

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